Boston-Logan International Airport

EDR

2014 Environmental Data Report

September 2015
EOEA #3247

SUBMITTED TO
Executive Office of Energy and
Environmental Affairs, MEPA Office

SUBMITTED BY
Massachusetts Port Authority
Strategic & Business Planning

PREPARED BY
vhb

IN ASSOCIATION WITH
Harris Miller Miller & Hanson, Inc.
KB Environmental Sciences, Inc.
ICF International, Inc.

Boston-Logan International Airport






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September 30, 2015

The Honorable Matthew Beaton, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: ***Boston-Logan International Airport 2014 Environmental Data Report* (*2014 EDR*) - EEA #3247**

Dear Secretary Beaton:

On behalf of the Massachusetts Port Authority (Massport), I am pleased to submit for your review, the *Boston-Logan International Airport 2014 Environmental Data Report* (*2014 EDR*). Massport is proud of its decades-long commitment to providing timely and extensive information to the public and regulators on Logan Airport environmental conditions; passenger activity levels and aircraft operations; ground access; planning activities; and updates on mitigation programs. Massport is the only airport in the United States that has consistently reported on environmental conditions on an annual basis since 1978. This "environmental report card" documents Massport's commitment to operating Logan Airport safely and efficiently, while minimizing impacts to the community and environment.

Logan Airport continues to experience change. In 2014 it saw an increase in passengers' activity levels that marked a continued recovery from the recent economic recession, as airlines serving Logan Airport continued to upgrade their fleets with newer and larger aircraft with improved environmental performance. Massport opened the new Rental Car Center – Logan's first LEED® Certified Gold building. The long-awaited East Boston Greenway Connecter opened in July 2014, as work on the Neptune Road Edge Buffer commenced.

Air traffic increases continued to be driven primarily by the growth of low-cost carriers, including JetBlue Airways and Southwest Airlines, and a significant increase in demand for international air service to existing and new destinations. In 2014, Logan Airport served 31.6 million passengers, exceeding the previous 2013 historic peak. Despite this growth in number of passengers, annual aircraft operations were nearly 140,000 operations below the historic peak of over 507,000 annual operations, reached in 1998 when Logan Airport served 26.5 million passengers.

As described throughout the *2014 EDR*, Massport remains fully committed to minimizing the effects of Airport operations and to a continued collaboration with the community. The contents of the *2014 EDR* are outlined below.

Content and Structure

The *2014 EDR* responds fully to the Secretary's Certificate on the *Boston-Logan International Airport 2012/2013 Environmental Data Report*, including responding to all comments. The document reports on the status of airport operations, environmental conditions, and Massport milestones achieved in 2014 and provides updates on more recent significant Logan Airport planning activities. The EDR also updates 2014 conditions for the following categories:

- Passenger levels, aircraft operations, aircraft fleets, and cargo volumes;
- Planning, design, and construction activities at Logan Airport;
- Regional transportation statistics and initiatives;

- Key environmental indicators (Ground Access, Noise Abatement, Air Quality/Emissions Reduction, and Water Quality/Environmental Compliance and Management);
- Status of Logan Airport project mitigation; and
- Sustainability initiatives.

The 2014 EDR also includes:

- Secretary's Certificate on the *Boston-Logan International Airport 2012/2013 EDR* and other comment letters received on the *2012/2013 EDR*;
- Proposed scope for the *2015 EDR;*
- Distribution list; and
- Supporting technical appendices (included in the attached CD).

Review Period, Distribution, and Consultation

A 30-day public comment period for the *2014 EDR* will begin on **October 7, 2015**, the publication date of the next Environmental Monitor, and will end on **November 6, 2015**. The distribution list included as Appendix D indicates which listed parties will receive a digital and/or printed copy of the *2014 EDR*. The full *2014 EDR* will also be available on Massport's website (www.massport.com).

A MEPA consultation session on the *2014 EDR* is scheduled for **October 20, 2015 at 4:00 PM**, in the Noddle Island Community Room of the new Rental Car Center, 15 Transportation Way, East Boston (Logan Airport). Additional copies of the *2014 EDR* may be obtained by calling (617) 568-3507 or emailing sdalzell@massport.com during the public comment period.

Future Filings and Timing

Starting in 1997, Massport has followed a five-year filing cycle for the *EDRs* and Environmental Status and Planning Reports (*ESPRs)*, with EDRs filed for each year between the ESPRs. The last Logan Airport ESPR was filed for calendar year 2011, a combined *2012/2013 EDR* was filed in December, 2014 and this *2014 EDR* will be filed on September 30, 2015. The *2015 EDR* is planned to be filed in late 2016.

Massport hopes that you and the other reviewers of the *2014 EDR* find it informative and complete. We look forward to your review of this document and to close consultation with you and other reviewers in the coming weeks. Please feel free to contact me at (617) 568-3524, if you have any questions.

Very truly yours,

Massachusetts Port Authority

Stewart Dalzell, Deputy Director
Environmental Planning & Permitting,
Strategic & Business Planning Department

cc: *2014 EDR* Distribution List (Appendix D in the *2014 EDR*)
Betty Desrosiers, Massport

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Introduction/ Executive Summary

Introduction

Massport is pleased to continue its practice of providing the community with an extensive, almost three-decade record of Boston-Logan International Airport (Logan Airport or Airport) environmental trends, development planning, operations and passenger levels, and Massport's mitigation commitments in this *Logan Airport 2014 Environmental Data Report (EDR)*. Logan Airport, owned and operated by the Massachusetts Port Authority (Massport), is New England's primary international and domestic airport. The *2014 EDR* is one in a series of annual environmental review documents submitted to the Massachusetts Environmental Policy Act (MEPA)[1] Office since 1979 to report on the cumulative environmental effects of Logan Airport's operations and activities. Logan Airport is the first airport in the nation for which an annual environmental report card on airport activities was prepared; Massport continues to be a leader in environmental reporting.

Approximately every five years, Massport prepares an Environmental Status and Planning Report (ESPR), which provides an historical and prospective view of Logan Airport. EDRs, prepared annually in the intervals between ESPRs, provide a review of environmental conditions for the reporting year compared to the previous year. Since 2000, environmental impacts associated with Logan Airport have been steadily decreasing, as reported on each year in the EDR/ESPR filings. This *2014 EDR* follows the *2012/2013 EDR* and reports on 2014 conditions. In 2014 at Logan Airport, the air quality and noise environment are substantially better than conditions reported during the 1990s and

Annual Environmental Data Reports and Environmental Status and Planning Reports since 1991.
Source: VHB

1 Massachusetts General Laws Chapter 30, Sections 61-62H. MEPA is implemented by regulations published at 301 Code of Massachusetts Regulations (CMR) 11.00 (the "MEPA Regulations").

early 2000s. This improvement is a result of both Massport's efforts to mitigate environmental impacts and airline industry trends towards greater efficiency.

The scope for this *2014 EDR* was established by the Secretary of the Executive Office of Energy and Environmental Affairs' (EEA) Certificate dated February 6, 2015, which is included in *Appendix A, MEPA Certificates and Responses to Comments*. This *2014 EDR* updates and compares the data presented in the *2012/2013 EDR*, and for 2014 presents information on:

- Activity Levels (including aircraft operations, passenger activity, and cargo)
- Airport Planning activities and upcoming projects
- Logan Airport's role in the regional transportation network
- Ground Access to and from the Airport
- Noise Abatement
- Air Quality Emissions Reduction
- Water Quality/Environmental Compliance
- Mitigation Commitments
- Sustainability and Resiliency

To enhance the usefulness of this *2014 EDR* as a reference document for reviewers, this report also presents historical data on the environmental conditions at Logan Airport dating back to 1990, in instances where historical information is available. Historical data are included in the technical appendices (CD only).

EOEA # 3247

Submitted By

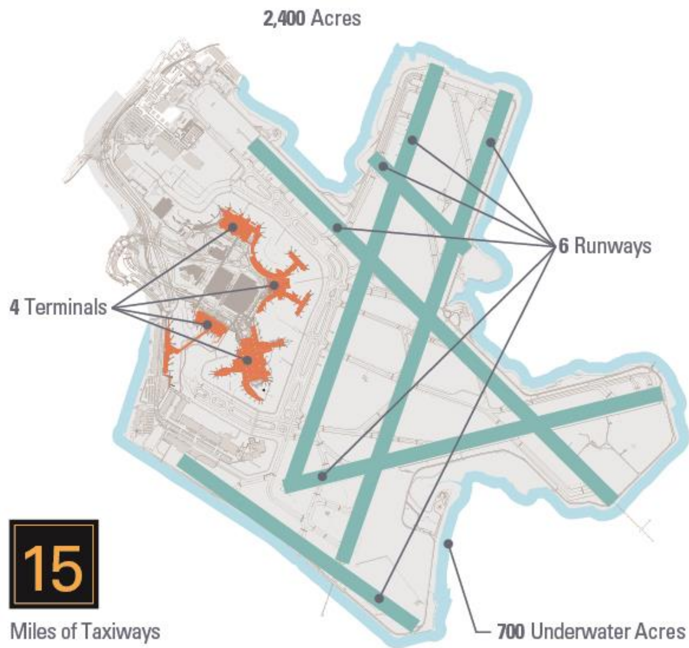
Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128

Stewart Dalzell, Deputy Director
Strategic & Business Planning
(617) 568-3524

Logan Airport Planning Context

Logan Airport, New England's primary domestic and international airport, plays a key role in the metropolitan Boston and New England passenger and freight transportation networks and is a significant contributor to the regional economy. Logan Airport fulfills a number of roles in the local, New England, and national air transportation networks. It serves as the primary airport serving the Boston metropolitan area, is the principal New England airport for long-haul services, and is a major U.S. international gateway airport for transatlantic services. Logan Airport serves as a regional connecting hub for small northern New England markets and the Massachusetts maritime counties of Barnstable, Dukes, and Nantucket; the Airport is also the busiest air cargo center in New England.

Figure 1-1 Logan Airport Layout



The Airport boundary encompasses approximately 2,400 acres in East Boston and Winthrop, including approximately 700 acres underwater in Boston Harbor. Logan Airport, shown in Figures 1-1, 1-2, and 1-3, is one of the most land-constrained airports in the nation, and is surrounded on three sides by Boston Harbor.

Logan Airport is close to downtown Boston and is accessible by two public transit lines and a well-connected roadway system. The airfield comprises six runways, approximately 15 miles of taxiway, and approximately 240 acres of concrete and asphalt apron. Logan Airport has four passenger terminals (Terminal A, B, C, and E), each with its own ticketing, baggage claim, and ground transportation facilities. Massport continues to evaluate and implement enhancements to Logan Airport's security, operational efficiency, and accessibility to and from the Boston metropolitan area, while carefully monitoring the environmental effects of Logan Airport operations.

In 2014, Logan Airport was the 18th busiest U.S. commercial airport in North America as ranked by aircraft operations, and the 19th busiest in North America ranked by number of passengers.[2] In the international sector, in 2014 Logan Airport ranked as the 7th largest U.S. international transatlantic gateway, and 12th largest international gateway globally. Boston is an important national and international destination, and air carriers are looking to expand international service at Logan Airport based on current and anticipated demand.

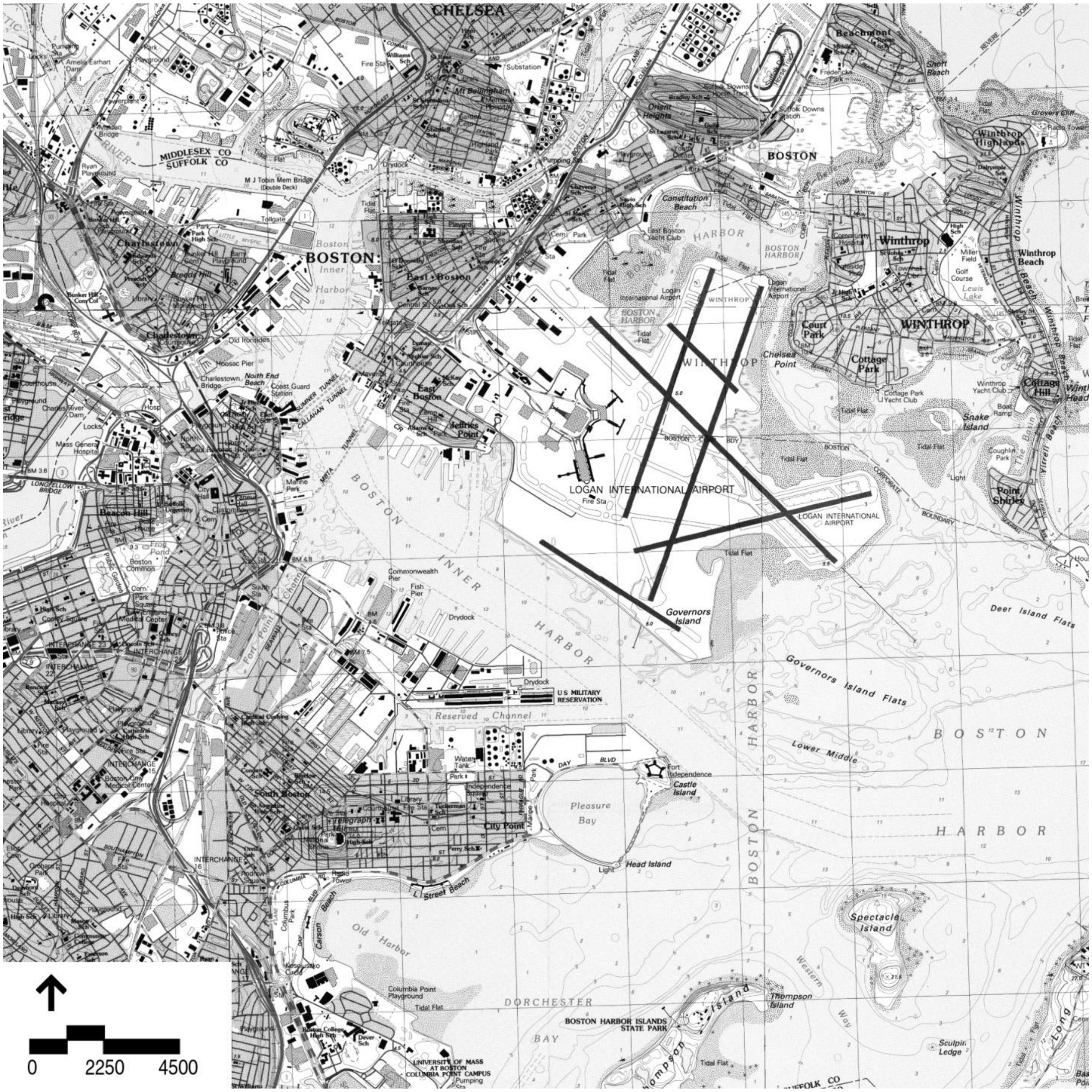
In 2014, approximately 12,000 people were employed at Logan Airport. This included approximately 960 Massport airport staff and administration employees.[3] Including airport-related activities, Logan Airport contributes $13.4 billion annually to the local economy. The Massachusetts Department of Transportation (MassDOT) Aeronautics Division's Statewide Airport Economic Impact Study found that in 2014, Logan Airport supported approximately 132,000 jobs. The total economic impact includes on-Airport, visitor-related, construction, and all associated multiplier impacts.[4]

Figure 1-2 Aerial View of Logan Airport

Source: Aerial photo, Massport, 2012.

2 Airports Council International, 2014 North American Air Traffic Report.
3 Massport Comprehensive Financial Report, 2015
4 MassDOT Statewide Airport Economic Impact Study, 2014.

Figure 1-3 Logan Airport and Environs



Source: U.S. Geological Service.

2014 Highlights and Key Findings

This section provides a brief overview of key findings, by chapter, at Logan Airport in 2014. Additional information concerning Airport activities is provided in subsequent chapters. Massport's efforts to further sustainability through specific projects and initiatives are highlighted with a sustainability leaf.

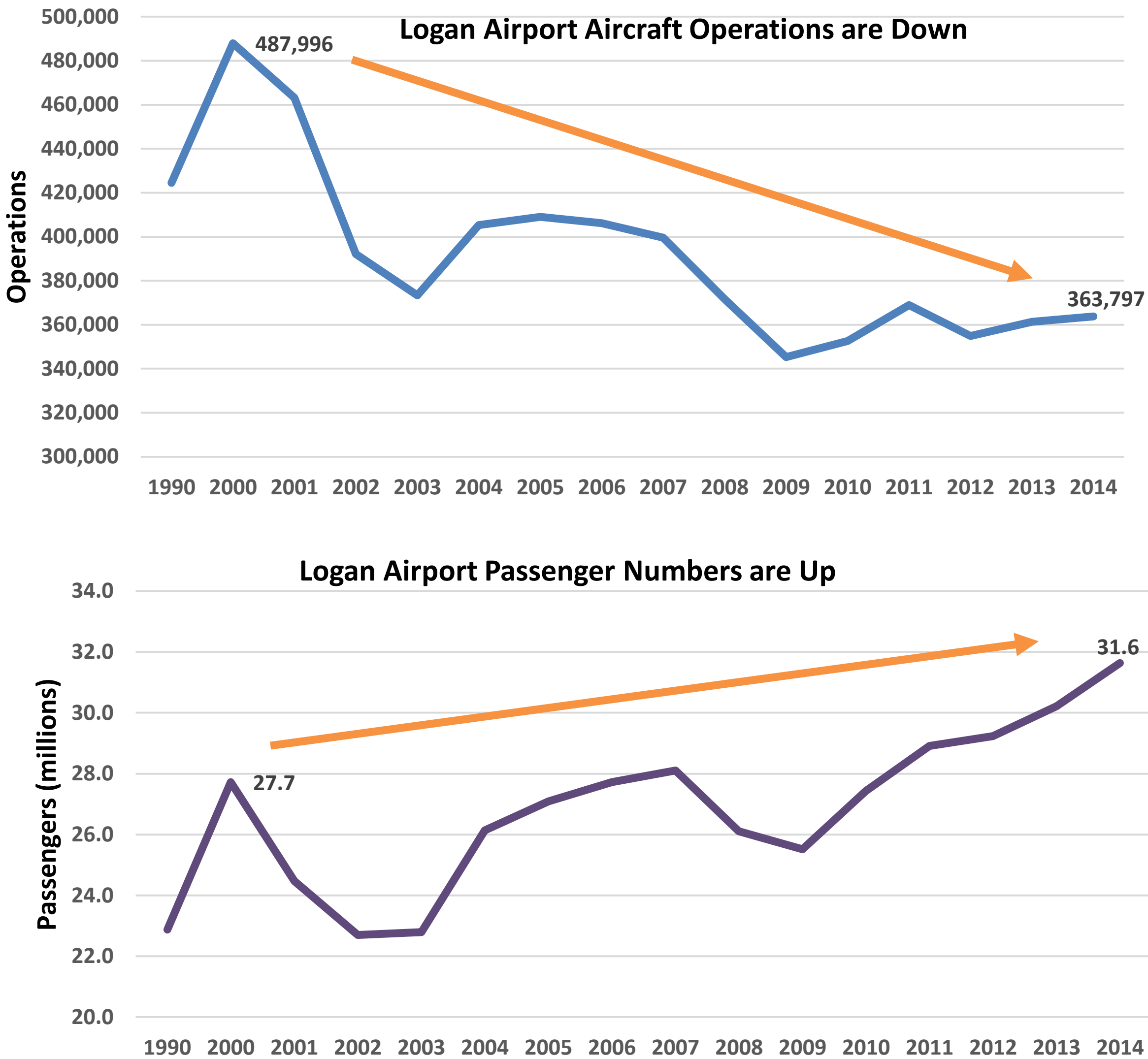
Activity Levels

- The total number of air passengers increased by 4.7 percent to 31.6 million in 2014, compared to 30.2 million in 2013 (Figures 1-4 and 1-5). The 2014 passenger level represents a new record high for Logan Airport.

- Passenger-aircraft operations accounted for 91 percent of total aircraft operations. The total number of aircraft operations increased slightly from approximately 361,339 in 2013 to 363,797 in 2014, a 0.7-percent increase. This was preceded by a 2.4-percent increase in 2013. Despite the increase, aircraft operations at Logan Airport remained well below the 487,996 operations in 2000 and the historical peak achieved in 1998. In 1986, Logan Airport served only 21.7 million air passengers compared to 31.6 million in 2014 with roughly the same number of total operations (363,995 operations).

- Aircraft efficiency continued to increase in 2014 as the average number of passengers per aircraft operation grew from 83.6 in 2013 to 87.0 in 2014. (Figure 1-4). This positive trend is indicative of the industry-wide shift toward higher aircraft load factors and greater efficiency and an increase in the number of domestic and international destinations.

Figure 1-4 Logan Airport Annual Passenger Activity Levels and Operations, 1990, 2000-2014



Source: Massport.

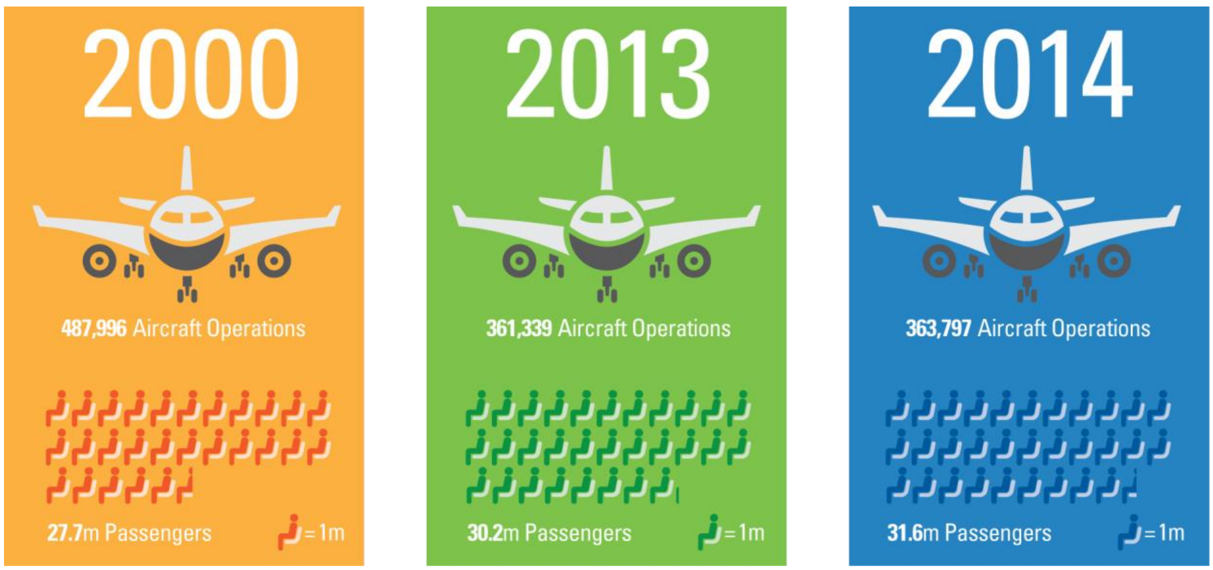
Logan Airport is an important origin and destination (O&D)[5] airport both nationally and internationally and has been one of the fastest growing major U.S. airports, in terms of number of passengers, over the last four years. There has been growth in both domestic and international passenger numbers. In 2014, there were approximately 4.9 million international and 26.5 million domestic passengers (excluding general aviation [GA]).

While both domestic and international passenger numbers are increasing, international passenger demand is projected to increase at a faster rate than domestic passenger demand. Total international annual passenger

5 "Origin and destination" traffic refers to the passenger traffic that either originates or ends at a particular airport or market. A strong O&D market like Boston generates significant local passenger demand, with many passengers starting their journey and also ending their journey in that market. O&D traffic is distinct from connecting traffic, which refers to the passenger traffic that does not originate or end at the airport but merely connects through the airport enroute to another destination.

numbers increased from 4.4 million in 2013 to 4.9 million in 2014, a 9.8-percent increase. The strong international passenger growth was driven by several new nonstop services introduced by a number of foreign airlines including Emirates, Turkish Airlines, Hainan Airlines, and Cathay Pacific. Recently launched international destinations include Mexico City, Tokyo, Beijing, Dubai, Istanbul, Panama City, Hong Kong, and Shanghai.

Figure 1-5 Logan Airport Annual Passenger and Operations, 2000, 2013, 2014



A series of positive factors have combined to produce this exceptional passenger growth. Continued economic growth is the key determinant of Logan Airport's long-term passenger demand. The forecast presented in the *2011 ESPR* was updated as part of an ongoing strategic planning effort. In the short-term, Logan Airport is projected to reach 32.9 million passengers in 2015.[6] According to the forecast scenario, Logan Airport's passenger traffic is forecast to reach 35 million annual passengers by 2022 or sooner.

International passengers made up approximately 16 percent of total Airport passengers in 2014, and this is projected to increase steadily to over 19 percent of the total by 2030. International air passengers are anticipated to reach 6 million by 2022 and 8 million by 2030.

Additional information is provided in *Chapter 2, Activity Levels.*

Airport Planning

Logan Airport facilities have been accommodating recent increases in passenger activity and operations on the airside, but the terminal, roadways, and parking facilities are strained by the increase in passengers. Upcoming planning projects and initiatives need to support this growth and projected future demand. Massport's key planning initiatives are focusing on meeting international passenger demand, providing an efficient roadway system and parking facilities, and enhancing passenger convenience. Select planning initiatives are described below. The status of all planning projects are described in *Chapter 3, Airport Planning.*

6 Massport and InterVISTAS forecast.

Airport Projects

- **Parking Consolidation Project.** Massport is consolidating 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all the remaining spaces permitted under the Logan Airport Parking Freeze.[7] The West Garage addition is atop the existing Hilton Hotel parking lot. The project will incorporate sustainable design and resiliency elements. The consolidation is expected to be completed in 2015.

- **Terminal E Renovation and Enhancements Project**. This project includes interior and exterior improvements at Terminal E to accommodate regular service by wider and longer Group VI aircraft. The project does not include any new gates, but will reconfigure three existing gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers).

  An addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the larger passenger loads associated with larger aircraft. The project also includes modifications to the airfield to meet required Federal Aviation Administration (FAA) safety and design standards to accommodate the larger aircraft. An Environmental Assessment (EA) was filed and FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2015. Construction commenced in 2015.

Boeing 787-8 aircraft at Logan Airport.
Source: Massport

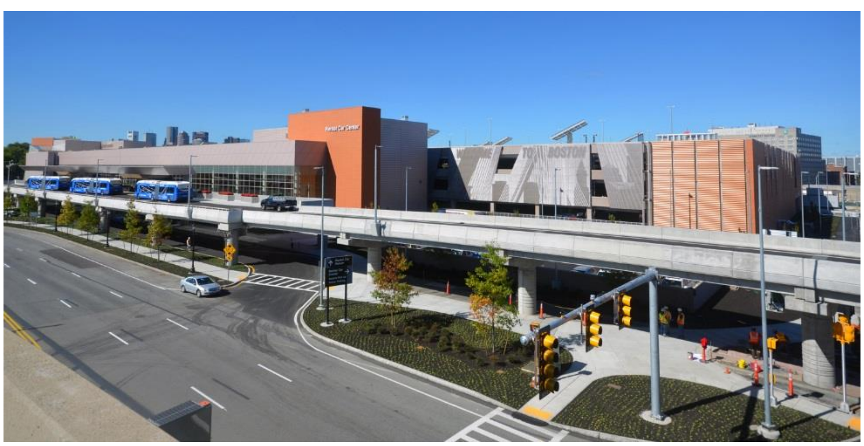
- **Terminal E Modernization Project.** To accommodate existing and long range forecasted demand for international service in an efficient, environmentally-sound manner that also improves customer service, Massport is planning to extend the existing International Terminal E. Modernizing Terminal E would add the three contact gates approved in 1996 as part of the International Gateway West Concourse project (EEA #9791), which were never constructed, and an additional two to four additional new gates in an extended concourse. The facility would be designed to function as a noise barrier. New passenger handling and passenger holdrooms are being planned, as well as possible additional Federal Inspection Services (FIS) and Customs and Border Patrol facilities to supplement the existing FIS areas in Terminal E. Previously a Satellite FIS Facility was planned and permitted in 2001 for Terminal B but never constructed (EEA # 9791). A key feature of this project is the first direct pedestrian connection from the MBTA Blue Line Airport Station to the terminal complex at Logan Airport. This project would also include improvements to Airport roadways to facilitate access. The project is in the conceptual design phase and initial construction would likely begin before 2018. Massport expects to file an Environmental Notification Form (ENF) in the very near future.

7 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

- **Logan Airport Greenway Connector Project.** The Logan Airport Greenway Connector ("Greenway Connector") is a pedestrian/bicycle path connecting the Bremen Street Park path to the future City of Boston Narrow Gauge Connector, a pedestrian/bicycle path that begins at the Greenway Overlook and continues to Constitution Beach. The Greenway Connector and the City of Boston Link provide a continuous pedestrian/bicycle path from Massport's Piers Park on the East Boston waterfront to Constitution Beach. Construction of the Greenway Connector began in spring 2013 and was completed in July 2014.

East Boston Greenway Connector
Source: VHB

- **Landside Ground Access Operating Improvements.** A series of recent projects have been designed to yield substantial environmental benefits, particularly in the areas of ground access efficiencies and associated air quality emissions reductions on-Airport and in East Boston, as documented below.
  - The Rental Car Center (RCC) reduces Airport VMT as well as improves roadway and intersection operations through: consolidating the rental car shuttle bus fleet and some Massport shuttle buses into a unified shuttle route system resulting in the elimination of eight rental car bus fleets (a net total of 66 buses have been eliminated); intersection and roadway infrastructure improvements including signal coordination and dedicated ramp connections; and creating a Ground Transportation Operations Center (GTOC), enabling efficient planning and operation of Airport-wide transit activities.



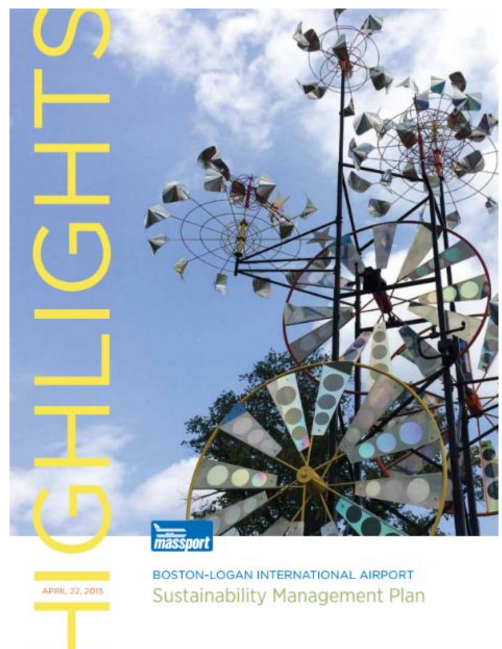
Logan Airport Rental Car Center
Source: Massport

  - Logan Airport's new bus fleet, comprising 18 compressed natural gas (CNG) buses and 32 clean diesel/electric buses, has fully replaced the entire fleet of diesel rental car shuttle buses now that the RCC is fully operational. Four additional new CNG buses were put into service in the summer of 2015, bringing the total to 22 buses.
  - The Green Bus Depot serves as Logan Airport's on-Airport maintenance facility for Massport's new clean-fuel bus fleet. By shifting the bus maintenance operations out of the community, Massport is reducing bus traffic in East Boston and Chelsea.

- The Martin A. Coughlin Bypass reduces commercial traffic through East Boston by providing a direct link between Logan Airport's North Service Area to the City of Chelsea for Airport-related vehicle trips.
- The Economy Parking Garage simplified and reduced on-Airport circulation by consolidating multiple overflow parking lots throughout the Airport into a single location served by a single shuttle route. Overall traffic circulating throughout the Airport has decreased, resulting in significant operational and environmental benefits.

Planning Initiatives

- **Strategic Planning.** In 2013, Massport began a strategic planning effort to position the Authority's aviation, maritime, and real estate lines of business, and its administrative support structures and workforce to meet the region's 21st century transportation and economic development challenges. The strategic planning initiative's primary goal formulates a vision for Massport as a transportation and economic development engine for the Commonwealth of Massachusetts in the 21st century.
- **Resiliency Planning.** At the end of 2013, Massport initiated the Disaster and Infrastructure Resiliency Planning Study (DIRP) for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis, modeling sea-level rise and storm surge, and projections of temperature and precipitation and anticipated increases in extreme weather events. The DIRP Study provides recommendations regarding short-term adaptation strategies to make Massport's facilities more resilient to the likely effects of climate change. The study was completed and a request for proposals for implementing its recommendations was issued in September 2014; work commenced in later 2014.
- **Logan Airport Sustainability Management Plan (SMP).** In 2013, Massport was awarded a grant by the FAA to prepare a SMP for Logan Airport. The Logan Airport SMP planning effort began in May 2013, and was completed in April 2015. The Logan Airport SMP takes a broad view of sustainability including economic vitality, social responsibility, operational efficiency, and natural resource conservation considerations, and is intended to promote and integrate sustainability Airport-wide and to coordinate ongoing sustainability efforts across the Authority. A copy of the SMP can be found at <ins>https://www.massport.com/environment/sustainability-management-plan/</ins>



Logan Airport Sustainability Management Plan
Source: Massport

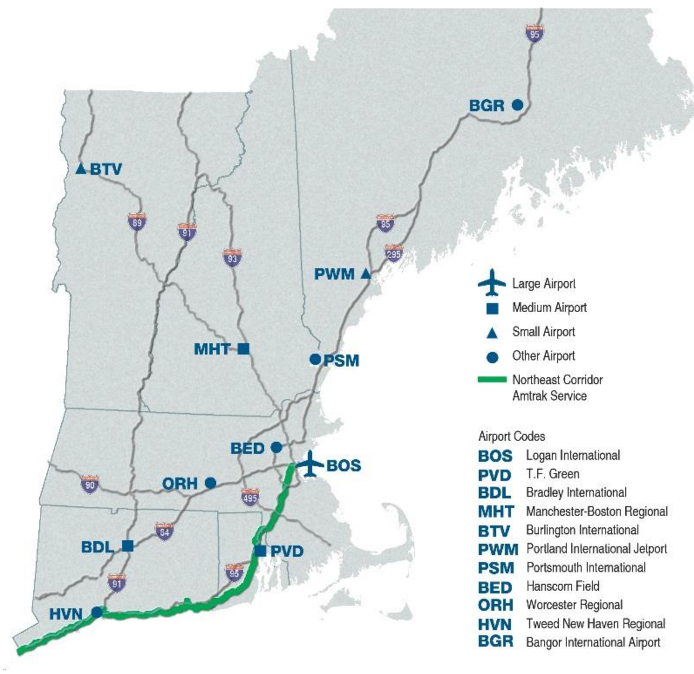
Regional Transportation

The New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever, and GA airports (regional airports).[8] Together, these 11 airports accommodate nearly all of New England's air travel demand (Figure 1-6). Logan Airport serves as a major domestic origin and destination market and acts as the primary international gateway for the region.

- Passenger traffic at the New England airports in 2014 represented the highest passenger traffic level for the region since the economic downturn in 2008. The increase in the region's passenger traffic was largely driven by continued growth at Logan Airport. In 2014, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased by 3.1 percent from 45.4 million in 2013 to 46.8 million annual air passengers in 2014.
- Of the 46.8 million passengers using New England's commercial service airports in 2014, 67.6 percent of passengers (31.6 million) used Logan Airport compared to 66.6 percent (30.2 million) in 2013.
- While passenger activity levels have increased (as noted above), aircraft operations in the New England region have decreased. In 2014, regional aircraft operations decreased by 4.3 percent, from 1.02 million operations in 2013 to 0.97 million operations in 2014.

Additional information is provided in *Chapter 4, Regional Transportation.*

Figure 1-6 New England Regional Transportation System



Ground Access to and from Logan Airport

Massport has continued to invest in and operate Logan Airport with a goal of increasing the number of passengers arriving by transit or other high occupancy vehicle (HOV) modes. The HOV/transit mode share at Logan Airport continues to rank at the top of U.S. airports.

Despite Massport's industry-leading efforts promoting and providing high occupancy vehicle (HOV)/shared-ride mode use, private passenger vehicle trips continue to increase with growth in air travel. As Logan Airport air traveler numbers have increased, a constrained parking supply at Logan Airport has resulted in an increase in "pick-up/drop-off" vehicle trips. The greater number of vehicle trips means

8 The New England Regional Airports Air Passenger Service Study (Federal Aviation Administration, 1995) defined the Bradley International, T.F. Green, Manchester-Boston Regional, Portland International Jetport, Bangor, Burlington, Worcester Regional, and Tweed-New Haven Airports as the region's principal commercial airports, other than Logan Airport, since all of these airports either supported or had previously supported commercial jet passenger services. Subsequently, in 1999, limited commercial passenger service was introduced at Hanscom Field and at Portsmouth International Airport, though neither airport has been able to sustain commercial airline services over the long-term. These 11 airports are included in the New England Regional Airport System Plan Study, which was published in 2006.

increasing vehicle miles traveled (VMT) and attendant emissions – the opposite effect of what the Logan Airport Parking Freeze regulation was intended to achieve.

Massport remains concerned that a constrained parking supply at the Airport will continue to cause an increase in both vehicle trips and curbside congestion due pick-up/drop-off activity by private vehicles. These trips increase automobile emissions both locally and regionally, which is contrary to the intended air quality goals of the Massachusetts State Implementation Plan (SIP).[9] As part of its Long-Term Parking Management Plan, Massport is considering a series of remedies to minimize increases in this type of pick-up/drop-off activity.

Key findings in 2014 are:

- The 2013 Air Passenger Survey revealed that 28 percent of air passengers use HOV/shared-ride modes to access the Airport. Massport continues to provide and actively promote HOV/shared-ride options to air passengers, including Logan Express bus service, free Silver Line boardings, water shuttle service, and free, frequent shuttle bus service to and from the Blue Line subway station.
- In 2014, VMT on-Airport decreased by 10.5 percent. The substantial decrease in on-Airport VMT is reflective of Massport's efforts to reduce VMT through the opening of the RCC, which: (1) consolidated rental car operations to one location; (2) provides one unified rental car shuttle; (3) relocated the taxi and limousine/bus pool closer to terminal area roadways; and (4) included additional improvements to alternative transportation systems. Now that these changes have been made, it is expected that VMT should grow at roughly the same pace as gateway traffic volumes. However, given that gateway traffic volumes grew by 5.3 percent in 2014 and corresponding parking activity grew by only 1.3 percent, trends indicate that vehicle pick-up/drop-off activity (and associated VMT to the Airport) is increasing at a much faster rate.
- Massport continued to be in full compliance with the Logan Airport Parking Freeze[10] regulations throughout 2014. Despite an increase in terminal area parking rates on July 1, 2014, daily parking demand more frequently approached the Parking Freeze cap in 2014. Massport is consolidating 2,050 temporary parking spaces in an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all remaining spaces permitted under the Logan Airport Parking Freeze.
- As air passenger levels have reached over 30 million, Logan Airport faces real challenges managing demand for on-Airport parking, resulting in a growing number of days in which arriving vehicles are diverted or moved to non-garage parking areas on (and sometimes off) the Airport. Increases in weekday peak commercial parking demand places additional pressure on roadway and parking operations under the Logan Airport Parking Freeze. In 2014, for example, due to high demand on Tuesdays, Wednesdays, and Thursdays, 30,314 cars were diverted to another garage or lot and 56,634 cars were valeted/stacked (when cars are parked in aisles, have their keys taken, and then are re-parked in empty spaces as they become vacant); this represents over a 50-percent increase since 2013. There were about 40 weeks in which one or more of these measures were put into effect in 2014.
- The constrained parking supply at Logan Airport has led to an increase in the pick-up/drop-off activity at the Airport. Pick-up/drop-off is the least desirable mode choice, since it can generate up to four vehicle

9 The Clean Air Act requires states to develop a general plan to attain and maintain the National Ambient Air Quality Standards (NAAQS) in all areas of the country and a specific plan to attain the standards for each area designated nonattainment for a NAAQS. These plans, known as State Implementation Plans or SIPs, are developed by state and local air quality management agencies and submitted to EPA for approval.

10 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.

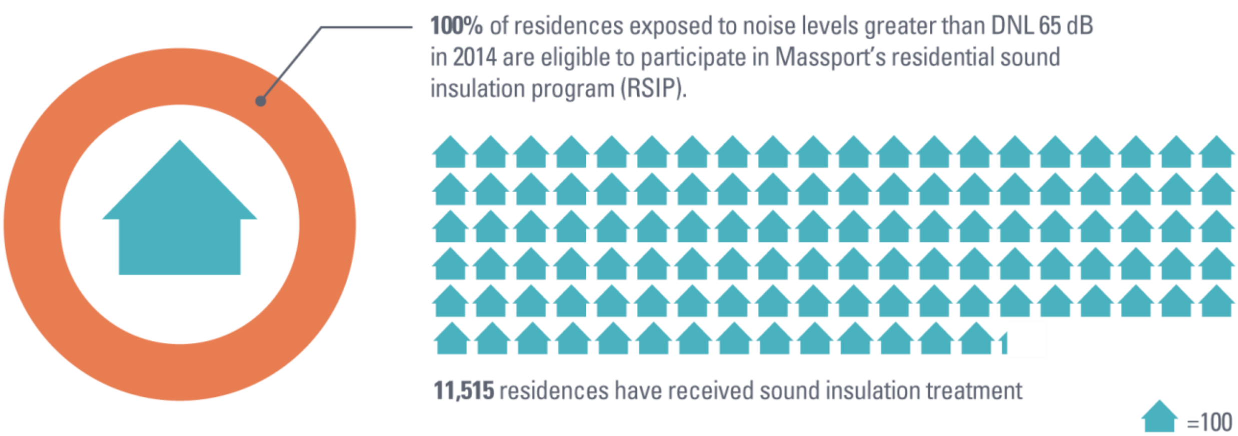
trips per air passenger trip.[11] As mentioned above, Massport is considering options to address this situation.

Additional information is provided in *Chapter 5, Ground Access to and from Logan Airport.*

Noise Abatement

Massport strives to minimize the noise effects of Logan Airport operations on its neighbors through a variety of noise abatement programs, procedures, and other tools. Logan Airport has one of the most extensive noise abatement programs of any airport in the nation. Massport's comprehensive noise abatement program includes a dedicated Noise Abatement Office; residential and school sound insulation programs; flight tracks designed to optimize over-water operations (especially during nighttime hours); and preferential runway use goals. In 2014, an additional 106 residential units received sound insulation bringing the program total to 11,515 residential units treated, amongst the highest in the nation (Figure 1-7).

Figure 1-7 Residences Treated through Massport Residential Sound Insulation Program (RSIP)



Since 2000, the number of daily aircraft operations has declined by almost 27 percent (from 1,355 operations per day in 2000 to 997 operations per day in 2014). This trend reflects an increase in the use of larger aircraft in the fleet, airline consolidation, and increased efficiencies on the part of airlines. As described throughout this EDR, this evolution towards fewer flights with larger, more efficient and quieter aircraft has yielded substantial environmental benefits. Compared to 2000, in 2014:

- Jet operations made up 86 percent of operations compared to 66 percent in 2000;
- Overall operations were down by 25 percent while overall passengers were up by 14 percent compared to 2000; and
- The number of people exposed to DNL 65 dB has declined by 50 percent since 2000.

11 For example, if an air passenger is dropped off by a friend when they depart on an air trip and is picked-up by a friend when she returns, that one air passenger generates a total of four ground-access trips: two for the drop-off trip (one inbound to Logan Airport, one outbound from Logan Airport) and two for the pick-up trip (one inbound to Logan Airport, one outbound from Logan Airport).

Compared to 2013, the 2014 DNL 65 dB noise contours were larger in most areas around the Airport. The DNL contour was larger over East Boston, Winthrop, and Revere. There were several temporary FAA- mandated airfield/airspace operating factors that influenced the contour changes in 2014, including:

- Due to safety concerns at airports across the United States in June of 2014, the FAA temporarily halted the use of head-to-head operations,12 or opposite direction operations, in which planes arrive on a runway in one direction and depart in the opposite direction. When in use at Logan Airport, the procedure has aircraft departing from Runway 15R and landing on Runway 33L during the late night (typically midnight to 5:00 AM) when weather conditions are appropriate, including good visibility and little wind. At Logan Airport, head-to-head operations are an important part of the use of the late night noise abatement runway (Runway 15R-33L) since this keeps operations over Boston Harbor. Use of this procedure was restored in early 2015.
- FAA also restricted the use of converging runways across the United States in January 2014 due to safety concerns. At Logan Airport, Runways 22L and 22R and Runway 27 were affected by this change. While Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 were sent by the FAA Air Traffic Control to arrive on Runway 22L. This restriction has since been lifted.
- Runway 15L-33R was closed for a short period of time (eight weeks) during the summer of 2014 for Runway Safety Area Improvements. This resulted in aircraft using Runway 15R-33L, Runway 4L, and Runway 22L more frequently in 2014 than in 2013. The construction activity also resulted in short closures of the intersecting Runway 4L-22R and Runway 4R-22L, which increased usage of Runway 15R-33L.

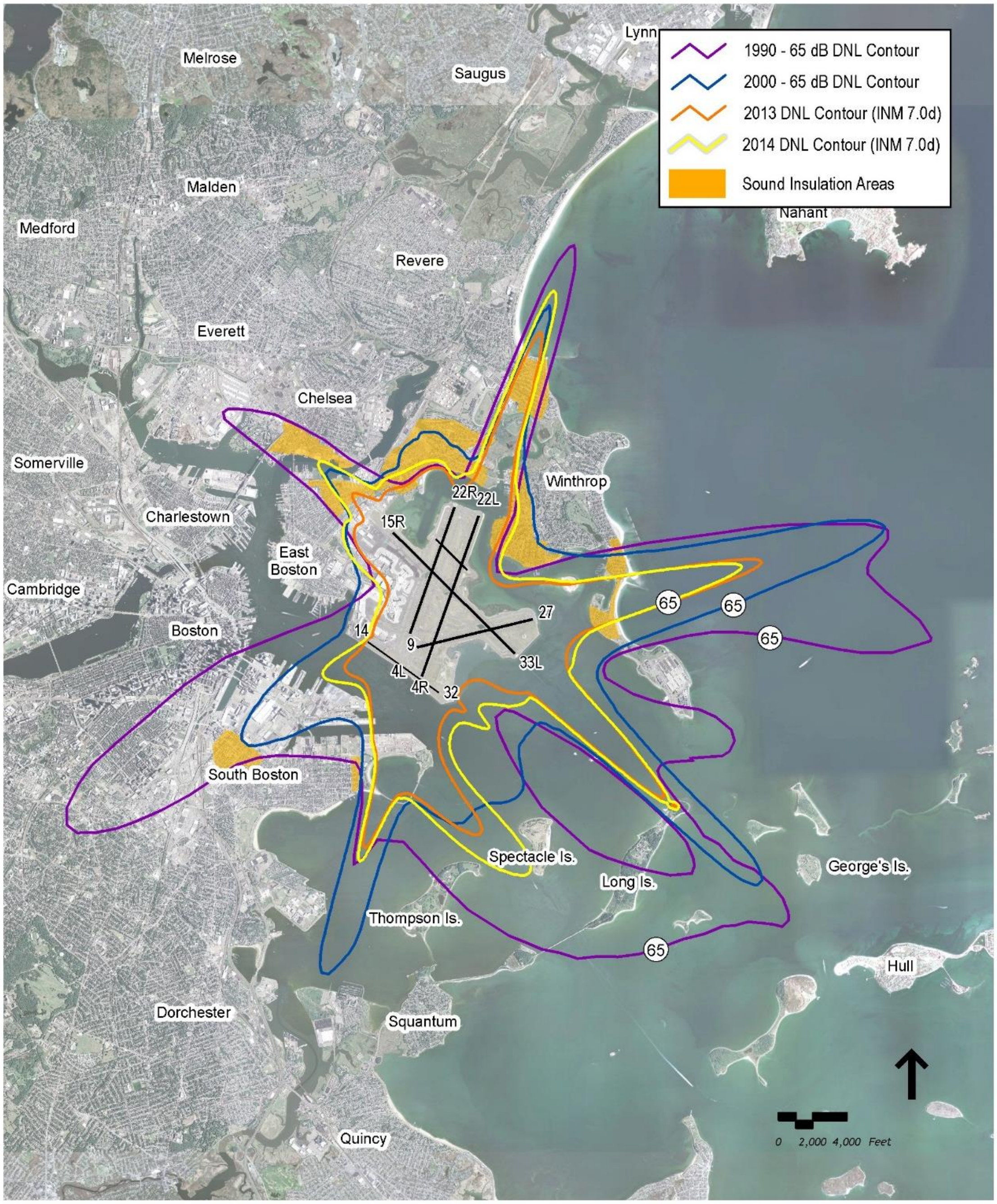
An additional factor influencing the contour changes was an increase in overall operations and nighttime operations in 2014 compared to 2013. Nighttime operations increased for passenger flights as airlines expanded destinations and the number of flights per day. Several new international airlines began service at Logan Airport in 2014.

As shown in Figure 1-8, the 2014 DNL 65 dB contour is somewhat larger than the 2013 DNL 65 dB contour. All homes within the expanded contour are within the previously approved sound insulation areas.

Additional information is provided in *Chapter 6, Noise Abatement*.

12 Head-to-head operations, or opposite direction operations, occur when aircraft depart from a runway end and aircraft are cleared to land to the opposite end of that runway. This results in aircraft overflights off only one end of the runway and is typically used as a noise abatement procedure when traffic levels are light.

Figure 1-8 Comparison DNL 65 dB Noise Contours (1990, 2000, 2013, and 2014)



Source: HMMH, MassGIS, USDA NAIP 2014

Comparison of Historical and Current 65 dB DNL Contours - 1990, 2000, 2013, and 2014

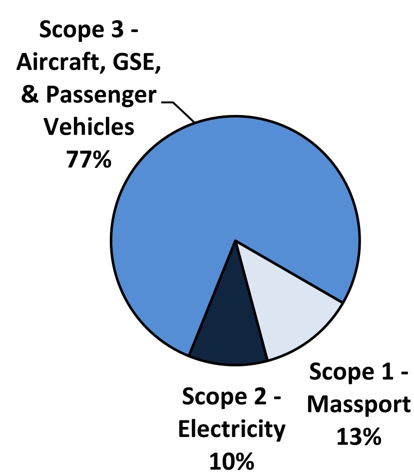
Air Quality/Emissions Reduction

Total air quality emissions from all sources associated with Logan Airport in 2014 are significantly less than they were a decade ago. This continuous downward trend is consistent with Massport's longstanding objective to accommodate the demands of increasing passenger and cargo activity levels with fewer aircraft operations generating less emissions. In 2014, calculated emissions of volatile organic compounds (VOC), oxides of nitrogen (NO_x), and particulate matter (PM) went up slightly. This was primarily attributable to changes in the modeling software, MOVES2014.

Overall, modeled air quality emissions were similar in 2014 to 2013 conditions and followed recent trends. The changes in 2014 modeled air quality emissions, as compared to 2013, are primarily due to technical changes in the model itself. Inputs to the model include aircraft operations, fleet mix characteristics, and airfield taxi times combined with ground service equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Model versions used in the 2014 analyses differed in terms of emission factors, most notably in the motor vehicle emission EPA model. The modeled air quality conditions in 2014 for Logan Airport were:

- Total VOC emissions went up by 3 percent (1,177 kilograms per day [kg/day]) in 2014 compared to 2013. The small increase is primarily due to the corresponding increase in aircraft landing and take-offs (LTOs) and an increase in jet fuel and gasoline usage when compared to 2013. For comparison, total VOC emissions were 1,777 kg/day in 2000.
- Total NO_x emissions went up by less than 1 percent in 2014 (4,040 kg/day) compared to 2013. This slight increase in 2014 is mostly attributable to the larger number of air carrier operations during this time period. For comparison, total NO_X emissions were 5,707 kg/day in 2000.
- Total CO emissions went down by 5 percent in 2014 (6,987 kg/day) compared to 2013. This decrease is mostly attributable to the decrease in GSE factors and motor vehicle emission factors in accordance with MOVES2014. For comparison, total CO emissions were 13,111 kg/day in 2000.
- Total $PM_{10}/PM_{2.5}$ emissions went up by approximately 3 percent in 2014 (95 kg/day) compared to 2013. This small increase is primarily attributable to the higher emission factors of MOVES2014.
- Total greenhouse gas (GHG) emissions went down by approximately 1 percent (0.60 MMT) in 2014 compared to 2013. The year 2014 marks the eighth consecutive year in which Massport has voluntarily prepared a GHG emissions inventory for the EDR/ESPR. This decrease was primarily due to a decrease in vehicle miles traveled (VMT). Sources of GHG emissions are shown in Figure 1-9.

Figure 1-9 Sources of GHG Emissions, 2014



Note: Scope 1 emissions are from sources that are owned or controlled by Massport, Scope 2 emissions are from electrical consumption, which are generated off-Airport at power generating plants, and Scope 3 emissions are from aircraft, GSE, and ground transportation to and from the Airport.

- Massport's Air Quality Initiative[13] (AQI) has tracked NO_x emissions since the benchmark year of 1999. Total NO_x emissions in 2014 were 722 tons per year (tpy) lower than the 1999 benchmark - which represents an overall decrease of 31 percent in NO_x emissions since 1999 when the program was initiated. For comparison, NO_x emissions in 2013 were 730 tpy lower than the benchmark.

Additional information is provided in *Chapter 7, Air Quality/Emissions Reduction.*

Water Quality/Environmental Compliance and Management

Massport's approach to environmental management and compliance is a key component of its commitment to sustainability and responsible stewardship at Logan Airport. Environmental performance is assessed through monitoring and documentation, allowing policies and programs to be developed, implemented, evaluated, and continuously improved.

Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts associated with airport activities. Massport employs several programs to promote awareness of Massport and tenant activities that may impact surface and groundwater quality, thus improving water quality. Programs include implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; training of staff and tenants; and a comprehensive stormwater pollution prevention plan. Massport continues to comply with water quality and other environmental regulations.

Additional information is provided in *Chapter 8, Water Quality/Environmental Compliance and Management.*

Sustainability at Logan Airport

Figure 1-10 EONS Approach to Sustainability

Massport is committed to a robust sustainability program. Sustainability has redefined the values and criteria for measuring organizational success by using a "triple bottom line" approach that considers economic, ecological, and social well-being. Applying this approach to decision-making is a practical way to optimize economic, environmental, and social capital. Massport is taking a broad view of sustainability that builds upon the triple bottom line concept, and considers the airport-specific context. Consistent with the Airports Council International - North America's (ACI-NA) definition of Airport Sustainability[14] (Figure 1-10), Massport is focused on a holistic approach to managing Logan Airport to ensure Economic viability, Operational efficiency, Natural resource conservation, and Social responsibility (EONS). Massport is commited to implement environmentally sustainable practices Authority- and Airport-wide, and continues to make

13 Massport developed the AQI as a 15-year voluntary program with the overall goal to maintain NOx emissions associated with Logan Airport at, or below, 1999 levels.
14 Airport Council International (ACI). Airport Sustainability: A Holistic Approach to Effective Airport Management. Undated. http://www.aci-na.org/static/entransit/Sustainability%20White%20Paper.pdf. Accessed July 17, 2013.

progress on a range of initiatives. Many of the long-term and multifaceted sustainability initiatives undertaken by Massport which are more fully described in individual chapters of this *2014 EDR* where appropriate, are described below.

Logan Aiport Sustainability Management Plan (SMP)

Massport is committed to reducing local environmental impacts without sacrificing service level; Massport's robust sustainability program is indicative of this commitment. In 2013, Massport was awarded a grant by the FAA to prepare a Sustainability Management Plan (SMP) for Logan Airport. The purpose of the SMP is to enhance the efficiency and sustainability of Logan Airport's operations and to support the broader sustainability priniciples of the Commonweath. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The plan, which takes a broad, holistic view of sustainability, is intended to promote and integrate sustainability Airport-wide and to coordinate ongoing sustainability efforts across the Authority. A baseline data assessment was completed in winter 2014 to assess current sustainability performance at the Airport. The Logan Airport SMP developed a framework and implementation plan, with metrics and targets, designed to track progress over time. Massport is currently advancing a series of short-term initiatives to help reach its goals (Table 1-1) in the areas of energy and greenhouse gas emissions; community, employee, and passenger well-being; resiliency; materials, waste management, and recycling; and water conservation. The Logan Airport SMP is available online at: https://www.massport.com/media/320786/LoganSMP_Report.pdf.

Logan Airport Sustainability Goals

As part of the SMP, Massport set a number of sustainability goals to improve and track Logan Airport's performance. Goals were set for 10 categories: Energy and Greenhouse Gases; Water Conservation; Community, Employee, and Passenger Well-being; Materials, Waste Management, and Recycling; Resiliency; Noise Abatement; Air Quality Improvement; Ground Access and Connectivity; Water Quality/Stormwater; and Natural Resources. Table 1-1 describes each goal as defined in the Logan Airport SMP. Massport's progress towards each goal and sustainability-related performance will be reported on in annual sustainability reports.

Table 1-1 Logan Airport Sustainability Goals and Descriptions

Sustainability Category	Goal	Sustainability Category	Goal
Energy and Greenhouse Gas Emissions	Reduce energy intensity and greenhouse gas emissions while increasing portion of Logan Airport's energy generated from renewable sources.	Water Conservation	Conserve regional water resources through reduced potable water consumption.
Community, Employee, and Passenger Well-being	Promote economically prosperous, and healthy communities and passenger and employee well-being.	Materials, Waste Management, and Recycling	Reduce waste generation, increase the recycling rate, and utilize environmentally sound materials.
Resiliency	Become an innovative model for resiliency planning and implementation among port authorities.	Noise Abatement	Minimize noise impacts from Logan Airport's operation.
Air Quality Improvement	Decrease emissions of air quality criteria pollutants from Logan Airport sources.	Ground Access and Connectivity	Provide superior ground access to Logan Airport through alternative and HOV travel modes.
Water Quality/Stormwater	Protect water quality and minimize pollutant discharges.	Natural Resources	Protect and restore natural resources near Logan Airport.

Sustainability in Planning, Design and Construction

The following sections outline Massport's sustainability achievements in the planning, design, and construction of projects.

LEED® Green Buildings at Logan Airport
The USGBC LEED® Green Buildings rating system is the most widely recognized third-party green building certification system in North America. Massport is striving to achieve LEED certification for new and substantial rehabilitation of building projects over 20,000 square feet. Some recent examples of LEED certified buildings at Logan Airport are the new RCC and the Green Bus Depot (Table 1-2). The new RCC in the Southwest Service Area (SWSA) began construction in 2010 and was completed in 2013. Massport is very proud that the RCC was awarded Logan Airport's first LEED Gold Certification in 2015. The LEED Silver Green Bus Depot shifted bus maintenance operations on-Airport from an off-Airport location. This reduced bus trips and unnecessary emissions on congested neighborhood roadways. Further details are available in *Chapter 3, Airport Planning.*

Figure 1-11 LEED® Certified Facilities at Logan Airport

Green Bus Depot, LEED Silver Certified (2014)

Rental Car Center, LEED Gold Certified (2015)

Signature Flight Support General Aviation Facility, LEED Certified (2008)

Terminal A, LEED Certified (2006)

Sustainable Design Standards and Guidelines (SDSG)
For smaller building projects and non-building projects, Massport uses the SDSG to incorporate sustainability into capital improvement projects. The SDSG, revised and reissued in March 2011, provides a sustainable building framework for design and construction of both new construction and rehabilitation projects for both building and non-building projects (for example, pavement projects). The SDSG applies to a wide range of project-specific criteria, such as site design, project materials, energy management and efficiency, air emissions, water management quality and efficiency, indoor air quality, and occupant comfort. The new standards have been used to guide over $200 million in capital projects Massport-wide between fiscal years 2010 to 2013, including over $30 million for maritime projects.

Table 1-2 LEED® Certified Buildings at Logan Airport

Terminal A (LEED Certified) Completed 2005/2006

- Priority curb locations for high occupancy vehicles (HOV) and bicycles
- Retrofitting with solar panels on the Terminal A roof
- Stormwater filtration
- Reflective roof
- Water use reduction features
- Natural daylighting paired with advanced lighting technologies for energy efficiency
- Use of recycled and regionally sourced materials
- Measures to enhance indoor air quality
- Roof-top solar

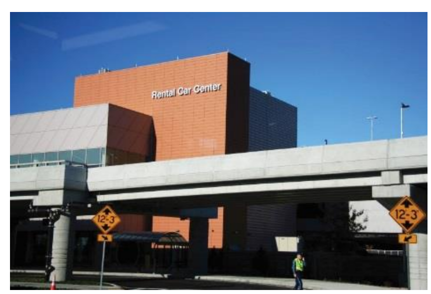
Signature Flight Support General Aviation Facility (LEED Certified) Completed 2007/2008

- Mechanisms to reduce water use
- Natural day lighting paired with advanced lighting technologies for energy efficiency
- Window glazing and sunshades to maximize daylight and minimize heat build-up
- Recycled and regionally sourced materials
- Measures to enhance indoor air quality

Green Bus Depot (LEED Silver Certified) Completed 2012

- Rooftop solar panels
- Water and energy saving features
- Vehicle miles traveled (VMT) reduction
- New shuttle fleet including 50 clean diesel/electric hybrid buses and CNG buses
- Sustainably grown, harvested, produced, and transported building materials

Rental Car Center (LEED Gold Certified) Completed 2013



- Green building materials
- Rooftop solar panels
- Bike and pedestrian access and connections
- Natural day lighting paired with advanced lighting technologies for energy efficiency
- Use of recycled and regionally sourced materials
- Enhanced indoor air quality
- Plug-in stations for electric vehicles and other alternative fuel sources such as E-85 (ethanol)
- Rental car fleets which include hybrid/alternative fuel/low emitting vehicles
- Pedestrian connections
- Bicycle facilities and employee showers/changing
- Water reclamation for vehicle wash water, and use of stormwater for non-potable uses such as vehicle washing and landscaping irrigation
- VMT reduction

Logan Airport Environmental Review Process

This *2014 EDR* is part of a well-established, state-level environmental review process that assesses Logan Airport's cumulative environmental impacts. The process provides a context against which individual Airport projects meeting state and federal environmental review thresholds are evaluated on a project-specific basis. The Airport-wide and project-specific environmental review processes are described below.

Historical Context for the Logan Airport EDR/ESPR

In 1979, the Secretary of the Executive Office of Environmental Affairs (EOEA) (now EEA) issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the Airport through a Generic Environmental Impact Report (GEIR). The Certificate also required interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR evolved into an effective planning tool for Massport and provided projections of environmental conditions so that the cumulative effects of individual projects could be evaluated within a broader context.

EEA eliminated GEIRs following the 1998 revisions to its MEPA Regulations. However, the Secretary's Certificate on the 1997 Annual Update[15] proposed a revised environmental review process for Logan Airport resulting in Massport's preparation of subsequent EDRs/ESPRs. The more comprehensive ESPRs provide a long-range analysis of projected operations and passengers while EDRs are prepared annually to provide review of environmental conditions for the reporting year compared to the previous year. In the last several years, aircraft operations and passenger activity levels and associated environmental effects have remained well below levels previously analyzed for Logan Airport. Thus, the forecasted aviation growth presented in the *2004 ESPR*, the predicate upon which the ESPR schedule was initially established, has not occurred. Accordingly, with the approval of the Secretary, Massport prepared *2009* and *2010 EDRs* in lieu of the ESPR originally planned for 2009. The *2011 ESPR*, filed in early 2013, reported on calendar year 2011 updated passenger activity level and aircraft operations forecasts. The *2012/2013 EDR* presented conditions for both calendar years 2012 and 2013.

This *2014 EDR* provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual passenger activity and aircraft operation levels in 2014 and presents environmental management plans for addressing areas of environmental concern. Massport proposes to prepare a *2015 EDR* to report on activity levels and environmental conditions for that year. The next anticipated ESPR will report on calendar year 2016. The *2016 ESPR* will report on updated passenger activity levels, aircraft operations forecasts, and environmental conditions forecasts. Where appropriate, Massport will continue to identify and address any longer-term aviation and environmental trends in both EDRs and ESPRs.

Project-Specific Review

While this Airport-wide review provides the broad planning context for proposed projects and future planning concepts, certain Airport projects are also subject to a project-specific, public environmental review process when state environmental review thresholds are met. When required, Massport and Airport tenants submit ENFs and Environmental Impact Reports (EIRs) pursuant to MEPA. Similarly, where National Environmental Policy Act (NEPA)[16] environmental review is triggered, projects are reviewed under the NEPA environmental review process.

15 Certificate of the Secretary of the Executive Office of Environmental Affairs on the Logan Airport 1997 Annual Update, issued on October 16, 1998.
16 42 USC Section 4321 et seq. The Federal Aviation Administration implements NEPA through Federal Aviation Administration Order 1050.1E, Environmental Impacts: Policies and Procedures, Federal Aviation Administration, United States Department of Transportation, Effective Date: March 20, 2006.

Organization of the *2014 EDR*

The remainder of this *2014 EDR* includes:

- ***Chapter 2, Activity Levels***, presents aviation activity statistics for Logan Airport in 2014 and compares activity levels to the prior year. The specific activity measures discussed include air passengers, aircraft operations, fleet mix, and cargo/mail volumes.
- ***Chapter 3, Airport Planning***, provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2014. It also describes known future planning, construction, and permitting activities and initiatives.
- ***Chapter 4, Regional Transportation***, describes activity levels at New England's regional airports in 2014 and updates recent regional planning activities.
- ***Chapter 5, Ground Access to and from Logan Airport***, reports on transit ridership, roadways, traffic volumes, and parking for 2014.
- ***Chapter 6, Noise Abatement***, updates the status of the noise environment at Logan Airport in 2014 and describes Massport's efforts to reduce noise levels.
- ***Chapter 7, Air Quality/Emissions Reduction***, provides an overview of Airport-related air quality in 2014 and efforts to reduce emissions.
- ***Chapter 8, Water Quality/Environmental Compliance and Management***, describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management.
- ***Chapter 9, Project Mitigation Tracking***, reports on Massport's progress in meeting its MEPA Section 61[17] mitigation commitments for specific Airport projects.

Supporting appendices include:

Appendices

- **MEPA Appendices**: These include the Secretary of EEA's Certificate on the *2012/2013 EDR*, comment letters received on the *2012/2013 EDR* and responses to those comments, Secretary Certificates on the annual reports issued for reporting years 2004 through 2011, a list of reviewers to whom the *2014 EDR* was distributed, and a proposed scope for the *2015 EDR*.

  Appendix A – MEPA Certificates and Responses to Comments
  Appendix B – Comment Letters and Responses
  Appendix C – Proposed Scope for the 2015 EDR
  Appendix D – Distribution List

17 Massachusetts General Law, Chapter 30, Section 61 (M.G.L. c. 30, § 61) states that all agencies must review, evaluate, and determine environmental impacts of all projects or activities and shall use all practicable means and measures to minimize damage to the environment. For projects requiring an Environmental Impact Report, Section 61 Findings will specify all feasible measures to be taken to avoid or mitigate environmental impacts, the party responsible for funding the mitigation measures, and the anticipated implementation schedule for mitigation measures.

- **Technical Appendices**[18]: These include detailed analytical data and methodological documentation for the various environmental analyses presented in and conducted for this *2014 EDR*.

  Appendix E – Activity Levels
  Appendix F – Regional Transportation
  Appendix G – Ground Access
  Appendix H – Noise Abatement
  Appendix I – Air Quality/Emissions Reduction
  Appendix J – Water Quality/Environmental Compliance and Management
  Appendix K – 2014 Peak Period Pricing Monitoring Report
  Appendix L – Reduced/Single Engine Taxiing at Logan Airport Memoranda

18 Technical appendices are included on the attached CD.

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Activity Levels

Introduction

This chapter reports on annual air traffic activity at Logan Airport in 2014, including air passengers, aircraft operations, aircraft fleet mix, and cargo volumes. Air traffic activity levels at Logan Airport form the basis for the evaluation of vehicle miles traveled (VMT), noise, and air quality impacts associated with the Airport. In this chapter, current activity levels at the Airport are compared to prior-year levels, and historical passenger and operation trends at Logan Airport dating back to 2000 are reviewed.[1]

Logan Airport is an important origin and destination (O&D)[2] airport both nationally and internationally and has been one of the fastest growing major U.S. airports, in terms of number of passengers, over the last four years. Passenger activity levels reached an all-time high of 31.6 million passengers and aircraft operations totalled 363,797 in 2014.

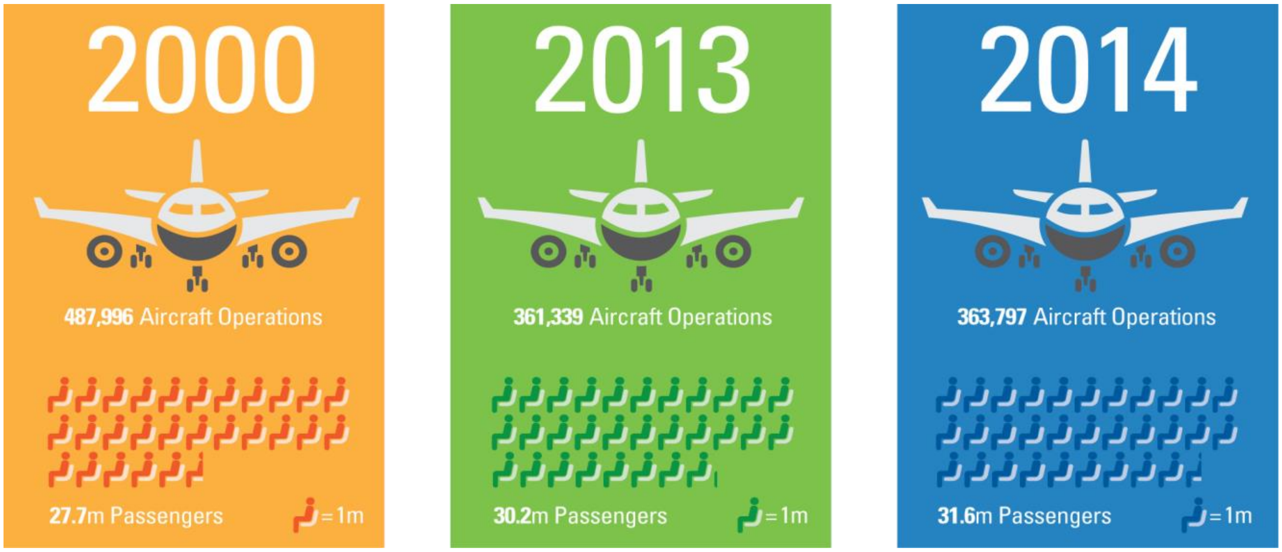
This chapter specifically describes 2014 activity levels, changes over the prior year, and historical trends for:

- Air passengers and aircraft operations
- Cargo and mail volumes
- Airline services

1 Refer to *Appendix E, Activity Levels* for available information dating back to 1980.
2 "Origin and destination" traffic, refers to the passenger traffic that either originates or ends at a particular airport or market. A strong O&D market like Boston generates significant local passenger demand, with many passengers starting their journey and also ending their journey in that market. O&D traffic is distinct from connecting traffic, which refers to the passenger traffic that does not originate or end at the airport but merely connects through the airport enroute to another destination.

2014 Activity Levels Highlights and Key Findings

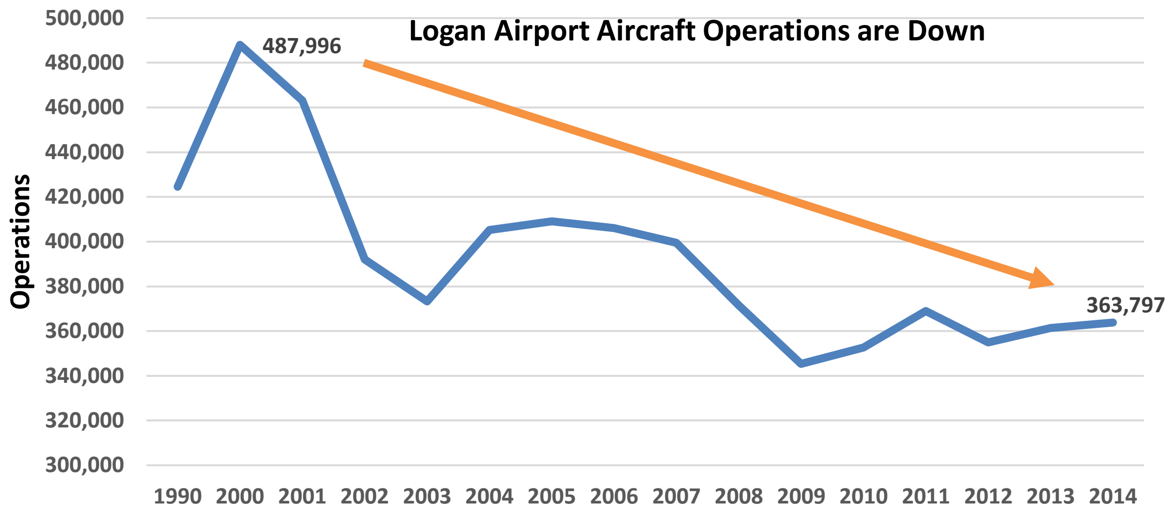
Notable changes in passenger, operations, and cargo activity at Logan Airport in 2014 are described below.

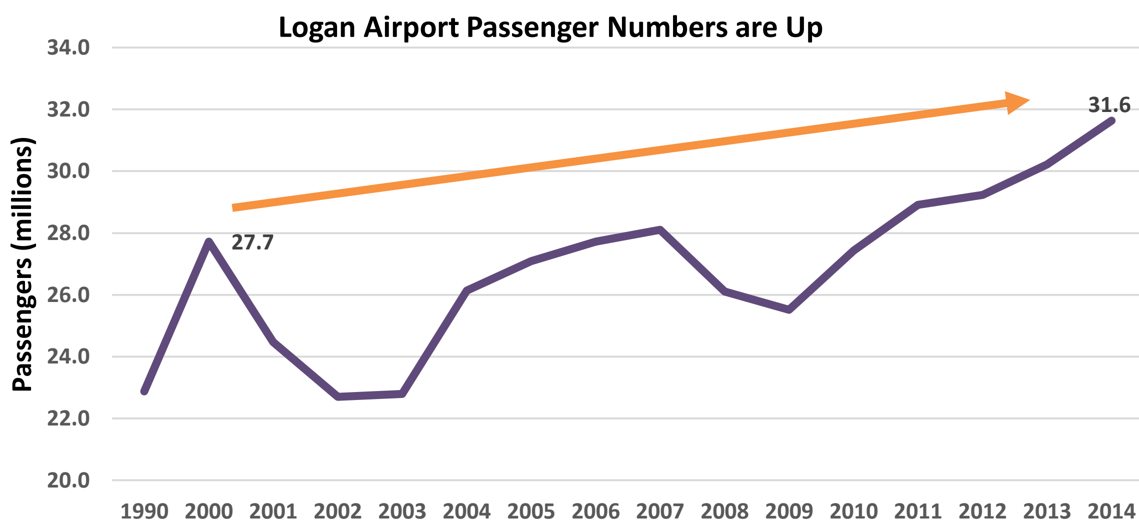


- From 2000 to 2014, the annual number of passengers at Logan Airport increased by 14.1 percent, while the annual number of aircraft operations[3] decreased by 25.5 percent.
- The total number of air passengers increased by 4.7 percent to 31.6 million in 2014, compared to 30.2 million in 2013 (Figure 2-1). The 2014 passenger level represents a new record high for Logan Airport.
- While both domestic and international passenger numbers are increasing, international passenger demand is projected to increase at a faster rate than domestic passenger demand. Total international annual passenger numbers increased from 4.4 million in 2013 to 4.9 million in 2014, a 9.8-percent increase. In 2014, there were 26.5 million domestic passengers[4] (excluding general aviation [GA]). The strong international passenger growth was driven by several new nonstop services introduced by a number of foreign airlines including Emirates, Turkish Airlines, Hainan Airlines, and Cathay Pacific. Recently launched international destinations include Mexico City, Tokyo, Beijing, Dubai, Istanbul, Panama City, Hong Kong, and Shanghai.
- The total number of aircraft operations at Logan Airport increased from 361,339 in 2013 to 363,797 in 2014, a 0.7-percent increase. This was preceded by a 2.4-percent increase from 2012 to 2013. Despite the increase, aircraft operations at Logan Airport remained well below the 487,996 operations in 2000 and the historic peak achieved in 1998. In 1986, Logan Airport served only 21.7 million air passengers, compared to 31.6 million in 2014, with roughly the same number of total operations as 2014.

3 An aircraft operation is defined as one arrival or one departure.
4 Excluding general aviation passengers.

Figure 2-1 Logan Airport Annual Passenger Activity Levels and Operations 1990, 2000-2014





Source: Massport

- Passenger aircraft operations accounted for 91 percent of total aircraft operations in 2014. While domestic operations remain the largest share of commercial operations, international operations have been growing steadily at Logan Airport. In 2014, domestic operations increased by 0.2 percent while international operations increased by 5.3 percent.
- JetBlue Airways' continued to expand at Logan Airport, increasing its total operations by 3.9 percent in 2014. As Logan Airport's largest carrier, JetBlue Airways accounted for 24.9 percent of total aircraft operations and 26.6 percent of total passengers in 2014.
- GA operations, which accounted for 7 percent of total operations in 2014, decreased by 1 percent from 2013.[5] This marked a continued contraction in GA activity after the rebound that occurred in 2010/2011 following the economic downturn. The 26,416 GA operations in 2014 remain well below the 35,233 GA operations that Logan Airport handled in 2000. Hanscom Field handled 133,700 GA operations in 2014.
- Air carrier efficiency continued to increase as the average number of passengers per aircraft operation grew from 83.6 in 2013 to 87.0 in 2014. At Logan Airport, the increasing number of passengers per flight reflects a shift away from smaller aircraft and rising load factors as airlines have reduced or restricted capacity growth after several airline mergers.
- Air cargo volumes, including shipments transported in the belly compartments of passenger aircraft, increased from 558 million pounds in 2013 to 593 million pounds in 2014, a 6.3-percent increase. Dedicated air cargo operations increased from 5,403 to 5,711, a 5.7-percent increase.
- A series of positive factors have combined to produce this exceptional passenger growth. Continued economic growth is the key determinant of Logan Airport's long-term passenger demand. The forecast presented in the *2011 Environmental Status and Planning Report (ESPR)* was updated as part of an ongoing strategic planning effort. In the short-term, Logan Airport is projected to reach 32.9 million passengers in 2015.[6] According to the forecast scenario, Logan Airport's passenger traffic is forecast to reach 35 million annual passengers by 2022 or sooner.
- International passengers made up approximately 16 percent of total Airport passengers in 2014 and this is projected to increase steadily to over 19 percent of the total by 2030. International air passengers are anticipated to reach 6 million by 2022 and 8 million by 2030.

Air Passenger Levels in 2014

The following section provides an overview of air passenger levels in 2014 for Logan Airport.

Logan Airport Passengers

Logan Airport is the principal airport for the greater Boston metropolitan area and the international and long-haul gateway for much of New England. Logan Airport was ranked the 18th busiest airport in North America in terms of passengers in 2014. Logan Airport served 31.6 million passengers in 2014, an increase of 4.7 percent over 2013. This represented a historic high for Logan Airport, exceeding the previous record of 30.2 million in 2013. Logan Airport is one of the fastest growing large hub airports in the U.S., with passenger growth continuing to outpace overall U.S. passenger growth. Total scheduled passenger traffic in the U.S. increased by only 3.1 percent[7] in 2014 compared to

5 General Aviation (GA) is defined as all aviation activity other than commercial airline and military operations.
6 Massport and InterVISTAS forecast.
7 Bureau of Transportation Statistics, 2014.

the passenger growth of 4.7 percent at Logan Airport. Factors that contributed to the strong passenger growth at Logan Airport in 2014 included:

- Strengthening economic growth and a gradual recovery in air travel demand across the nation;
- JetBlue Airways continued expansion at Logan Airport; and
- The introduction of new international services at Logan Airport and growing international passenger demand.

International passenger traffic at Logan Airport, in particular, has exhibited strong growth over the past several years. After two periods of decline and gradual recovery, Logan Airport's international traffic finally surpassed 2000 levels for the first time in 2013. In 2014, international passengers increased by an additional 9.8 percent. Since 2010, the international passenger segment has averaged 7.9 percent annual growth. This growth has been driven by the expansion of JetBlue Airways and Delta Airlines international service at Boston, as well as a rapid increase in foreign carrier service in recent years. Boston is currently the 12th largest U.S. gateway for international air travel, as well as the third largest U.S. gateway airport (after Honolulu and Fort Lauderdale) that is not also a connecting U.S. airline hub. The O&D strength of the Boston market makes Logan Airport an attractive gateway for foreign flag airlines. Additional trends in new aircraft technology allowing for smaller and more fuel efficient aircraft on international routes are also expected to continue to benefit mid-size O&D markets like Boston.

As shown in Table 2-1, domestic air passengers represent Logan Airport's largest market segment, accounting for 83.9 percent of total passengers in 2014. The domestic passenger market increased by 3.8 percent in 2014. Growth in JetBlue Airways' service network from Logan Airport and modest economic growth were the main contributors to growth in domestic passengers. JetBlue Airways carried 6.8 million domestic passengers at Logan Airport in 2014, compared to 6.6 million in 2013. However, other carriers at Logan Airport continued to contract in 2014 after a period of industry consolidation through airline mergers. JetBlue Airways' growth in the domestic market offset losses by other carriers in 2014.

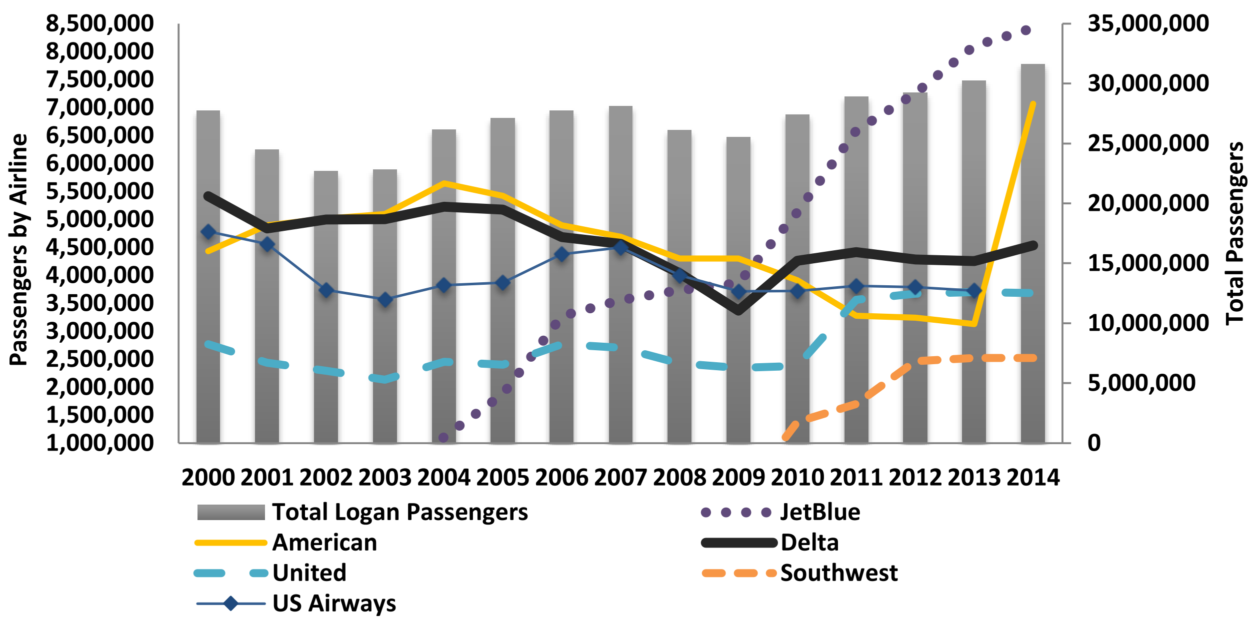
Table 2-1 Air Passengers by Market Segment, 1990, 2000, and 2010-2014

	1990	2000	2010	2011	2012	2013	2014	Percent Change (2013-2014)	Avg. Annual Growth (2010-2014)
Domestic	**19,519,247**	**23,100,645**	**23,688,471**	**24,579,780**	**24,743,008**	**25,578,080**	**26,545,978**	**3.8%**	**2.9%**
International	**3,358,944**	**4,513,192**	**3,681,739**	**4,215,071**	**4,383,945**	**4,546,018**	**4,992,225**	**9.8%**	**7.9%**
Europe/ Middle East	N/A	2,948,542	2,672,635	2,939,226	2,896,002	2,901,529	3,194,109	10.1%	4.6%
Bermuda/ Caribbean	N/A	693,620	486,911	700,267	793,953	863,842	887,301	2.7%	16.2%
Canada	N/A	833,669	518,088	573,660	614,879	643,987	669,546	4%	6.6%
Asia/Pacific	N/A	37,451	0	0	78,484	104,235	170,867	63.9%	New
Central/South America	N/A	0	4,105	1,918	627	32,425	70,402	117.1%	103.5%
General Aviation	**N/A**	**112,996**	**58,752**	**114,416**	**109,134**	**94,872**	**96,242**	**1.4%**	**13.1%**
Total Passengers	**22,878,191**	**27,726,833**	**27,428,962**	**28,909,267**	**29,236,087**	**30,218,970**	**31,634,445**	**4.7%**	**3.6%**

Source: Massport.
N/A Not available
Notes: Numbers in parenthesis () indicate negative number.
Reported International passengers include only international passengers using Logan Airport as an international gateway; a significant number of international O&D passengers also board domestic flights from Logan to connect over other U.S. gateways to international destinations.

Figure 2-2 shows the total annual passengers for the five dominant airlines at Logan Airport and highlights the rapid expansion of JetBlue Airways since 2004. Overall, the substantial low-cost carrier (LCC) growth at the Airport over the past decade – particularly the entry of JetBlue Airways in 2004 and its subsequent decision to expand and make Logan Airport one of its focus cities – has exceeded recent consolidation and contraction among other carriers serving Logan Airport.[8] Domestic passenger activity levels have recovered from the recent economic downturn in 2009, when domestic air passengers fell to 21.8 million, reaching a new peak of 26.5 million in 2014.

Figure 2-2 Annual Passengers at Logan Airport Served by Top Six Airlines, 2000-2014



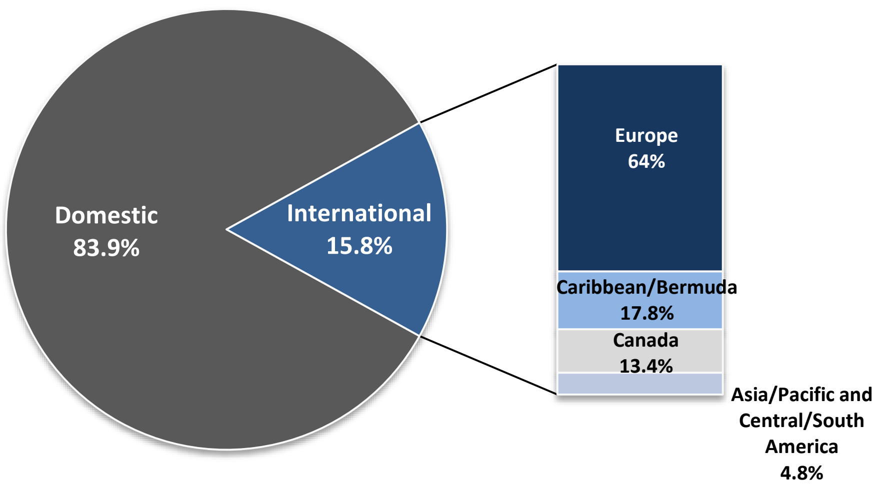
Source: Massport.
Notes: United Airlines totals in this chart include Continental Airlines beginning in 2011 (following 2010 merger), Delta Air Lines totals include Northwest Airlines beginning in 2010 (following 2009 merger), US Airways include America West Airlines beginning in 2005 (following 2005 merger), Southwest Airlines include AirTran Airways beginning 2012, United Airlines totals include Continental Airlines beginning in 2011, and American Airlines includes US Airways beginning in 2014. Totals for American Airlines, Delta Air Lines, United Airlines and US Airways include Delta Shuttle, US Airways Shuttle, and contract carriers doing business as Delta Connection, United Express, US Airways Express, American Eagle, or American Connection.

Logan Airport experienced substantial growth in international passenger activity levels in both 2013 and 2014 as airlines introduced a number of new international services. In 2013, international passenger traffic at Logan Airport increased by 3.7 percent over 2012 to reach 4.5 million, exceeding the historic international passenger peak achieved in 2000. International passenger growth accelerated in 2014, growing by 9.8 percent to reach a record 4.9 million. JetBlue Airways and Delta Airlines have both expanded international services at Logan Airport in recent years, with JetBlue Airways continuing to grow its Caribbean network and Delta Airlines introducing new nonstop service to Amsterdam, London Heathrow, and Paris De Gaulle. Logan Airport has also attracted a significant amount of foreign carrier service, including new service by Japan Airlines in 2012, Copa Airlines in 2013, and Emirates, Turkish Airlines, and Hainan Airlines in 2014.

8 Delta Air Lines and Northwest Airlines merged in 2009, United Airlines and Continental Airlines merged in 2010 and Southwest Airlines and AirTran Airways merged in 2012, but maintained separate schedules and operating identities through 2013. At Logan Airport, total passengers carried by the consolidated Delta Air Lines decreased 3.0 percent in 2012 and 0.7 percent in 2013. Total Logan Airport passengers carried by the consolidated United Airlines decreased by 1.7 percent in 2012 and increased by 5.6 percent in 2013. Total Logan Airport passengers for the combined Southwest Airlines/AirTran Airways entity decreased by 14.8 percent in 2012 and increased by 2.5 percent in 2013.

Figure 2-3 shows the distribution of Logan Airport passengers by market segment. Europe/Middle East was the dominant international destination market, accounting for 64.0 percent of international traffic and 10.1 percent of total traffic at Logan Airport. Passenger traffic to Europe/Middle East was up 10.1 percent in 2014, driven by new services to the Middle East by Emirates and Turkish Airlines. The Bermuda/Caribbean regions and Canada accounted for 17.8 percent and 13.4 percent of international passengers respectively in 2014, with traffic to Canada increasing by 4.0 percent. Asia/Pacific and Central/South America passenger traffic accounted for 3.4 percent and 1.4 percent of international passengers respectively, following the introduction of new airline service to those regions in 2014.

Figure 2-3 Distribution of Logan Airport Passengers by Market Segment, 2014



Source: Massport.
Note: General Aviation accounted for 0.3 percent of Logan Airport Passengers in 2014.

Aircraft Operation Levels in 2014

This section reports on aircraft operations levels for Logan Airport, including passenger aircraft operations, GA operations, all-cargo aircraft operations, and aircraft load factors.

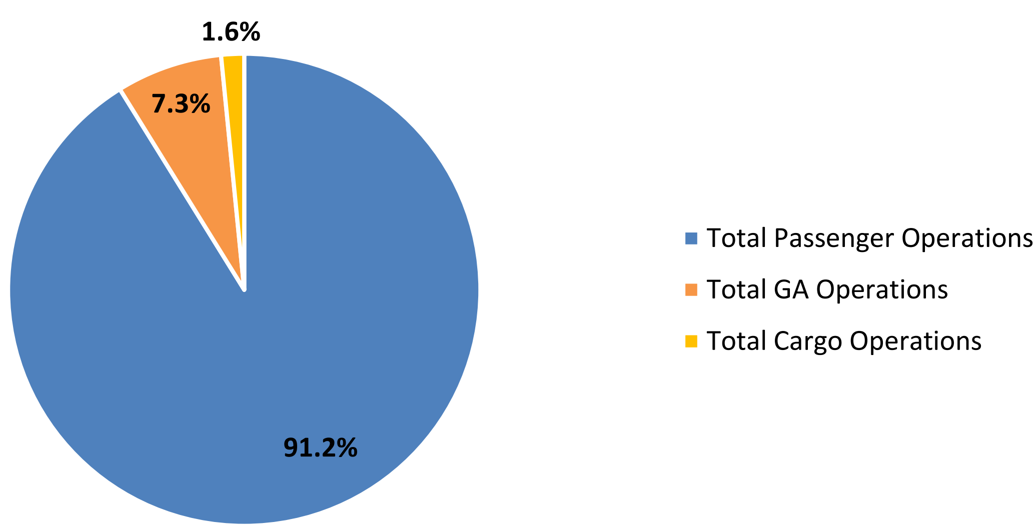
Logan Airport Aircraft Operations

From 1990 to 2014, Logan Airport passengers increased by 38.3 percent, while aircraft operations decreased by 14.3 percent. The total number of aircraft operations at Logan Airport increased by 0.7 percent from 361,339 in 2013 to 363,797 in 2014 (Table 2-2). As shown in Figure 2-4, passenger operations account for 91.2 percent of total aircraft operations, while GA and all-cargo operations account for 7.3 percent and 1.6 percent respectively. Overall, aircraft operations have decreased as a result of continuing increases in passenger load factors (the percentage of seats occupied by paying passengers) and the substitution of larger capacity aircraft for smaller capacity aircraft. Figure 2-5 depicts passengers and operations data since 1990, and shows how passenger levels have grown at Logan Airport while overall aircraft operations have decreased to levels well below the historical peak year of 2000 of 487,996 operations.

Table 2-2 Logan Airport Aircraft Operations (1990, 2000, and 2010 - 2014)									
Category	**1990**	**2000**	**2010**	**2011**	**2012**	**2013**	**2014**	**Percent change (2013-2014)**	**Avg. Annual Growth (2010-2014)**
Total Aircraft Operations	**424,568**	**487,996**	**352,643**	**368,987**	**354,869**	**361,339**	**363,797**	**0.7%**	**0.8%**
Operations by Type and Aircraft Class									
Passenger Jet	N/A	254,968	214,307	223,083	225,166	233,072	240,254	3.1%	2.9%
Passenger Regional Jet	N/A	37,600	66,498	61,704	46,753	47,875	44,079	(7.9%)	(9.8%)
Passenger Non-Jet	N/A	147,913	50,882	49,700	49,599	48,307	47,339	(2.0%)	(1.8%)
Total Passenger Operations	**N/A**	**440,481**	**331,687**	**334,487**	**321,518**	**329,254**	**331,672**	**0.7%**	**0.0%**
GA Jet Operations	N/A	20,595	11,430	21,129	21,042	21,237	21,025	(1.0%)	16.5%
GA Non-Jet Operations	N/A	14,638	3,252	7,101	7,072	5,445	5,391	(1.0%)	13.5%
Total GA Operations	**24,976**	**35,233**	**14,682**	**28,230**	**28,114**	**26,682**	**26,416**	**(1.0%)**	**15.8%**
Cargo Jet	N/A	11,788	5,332	5,053	4,220	4,647	4,910	5.7%	(2.0%)
Cargo Non-Jet	N/A	494	942	1,217	1,017	756	799	5.7%	(4.0%)
Total Cargo Operations	**N/A**	**12,282**	**6,274**	**6,270**	**5,237**	**5,403**	**5,709**	**5.7%**	**(2.3 %)**

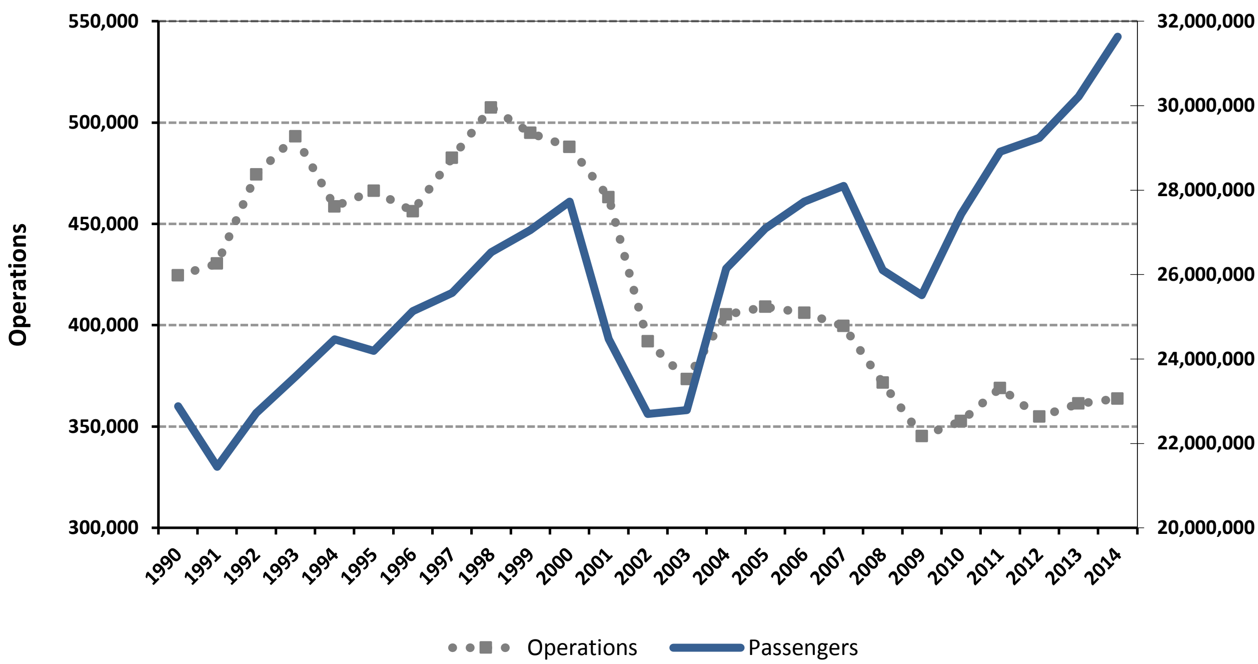
Source: Massport
NA Not Available
Notes: Jet includes the Embraer E-190, which is a regional jet configured with 88-100 seats, but is similar in size to some traditional narrow-body jets.
Numbers in parenthesis () indicate negative numbers.

Figure 2-4 Logan Airport 2014 Aircraft Operations by Type



Source: Massport

Figure 2-5 Logan Airport Historical Air Passenger and Aircraft Operations, 1990-2014



Source: Massport

Passenger Operations

Logan Airport accommodated 331,672 passenger aircraft operations in 2014, a 0.7-percent increase from 2013. Passenger aircraft operations represented 91.2 percent of total aircraft operations in 2014, GA operations represented 7.3 percent, and cargo operations represented 1.6 percent (Figure 2-4).

The dominant carriers at Logan Airport based on the number of aircraft operations in 2014 are shown in Figure 2-6. JetBlue Airways, the newly merged American Airlines/US Airways, Delta Air Lines, Cape Air, and United Airlines were the top carriers in 2014 based on the number of aircraft operations.[9] In 2014, JetBlue Airways accounted for approximately 82,595 operations, American Airways/US Airways accounted for 69,844 operations, and Delta Air Lines ranked third with 46,975 operations. Cape Air, United Airlines, and Southwest Airlines ranked fourth, fifth, and sixth, respectively, in 2014 with 35,080 operations, 30,019 operations, and 18,525 operations respectively.

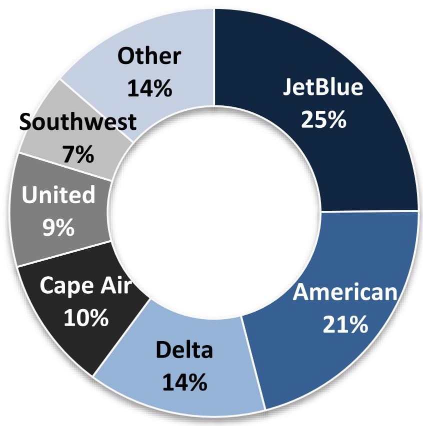
Passenger Regional Jet (RJ) operations (jet aircraft with fewer than 90 seats) and non-jet passenger operations decreased by 7.9 percent and 2.0 percent respectively in 2014, while jet passenger operations increased by 3.1 percent.[10] RJ operations have been declining steadily since 2006, as airlines eliminated unprofitable services to small and medium size markets and consolidated services after a period of airline mergers. The decreases in RJ operations reflected the retirements of smaller RJs with 30 to 50 seats.

9 Airline rank is based on total number of operations for carrier "families," including activity for all regional airlines partners and subsidiaries.

10 In this report, the term regional jet refers to small jet aircraft with fewer than 90 seats. The Embraer-190, operated by JetBlue Airways and US Airways at Logan Airport, carries up to 100 and 99 passengers respectively, and is considered a jet.

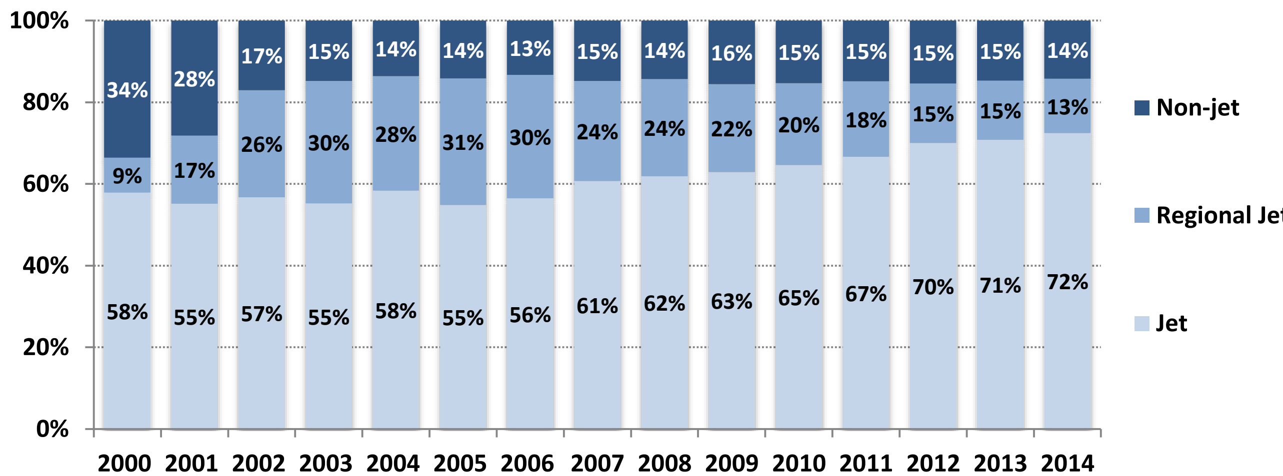
The change in mix of passenger aircraft operations since 2000 is shown in Figure 2-7. RJs accounted for 13 percent of total passenger operations in 2014, compared to 31 percent at the peak level in 2005. Similarly, non-jets have declined from a high of 34 percent in 2000 to 14 percent in 2014.

Figure 2-6 Dominant Passenger Carriers at Logan Airport by Aircraft Operations, 2014



Notes: Totals for American Airlines, Delta Air Lines, and United Airlines include all regional affiliates and contract carriers.
American Airlines includes US Airways (2014 merger) and Southwest Airlines includes AirTran Airways (2012 merger)
"Other" category includes all other carriers which have a smaller portion of aircraft operations at Logan Airport. This category includes but is not limited to Air Canada, Porter Airlines, British Airways, and Lufthansa, which provide year-round and seasonal service to Logan Airport.

Figure 2-7 Passenger Aircraft Operations at Logan Airport by Aircraft Type, 2000-2014



Source: Massport.

Passengers Per Aircraft and Load Factors

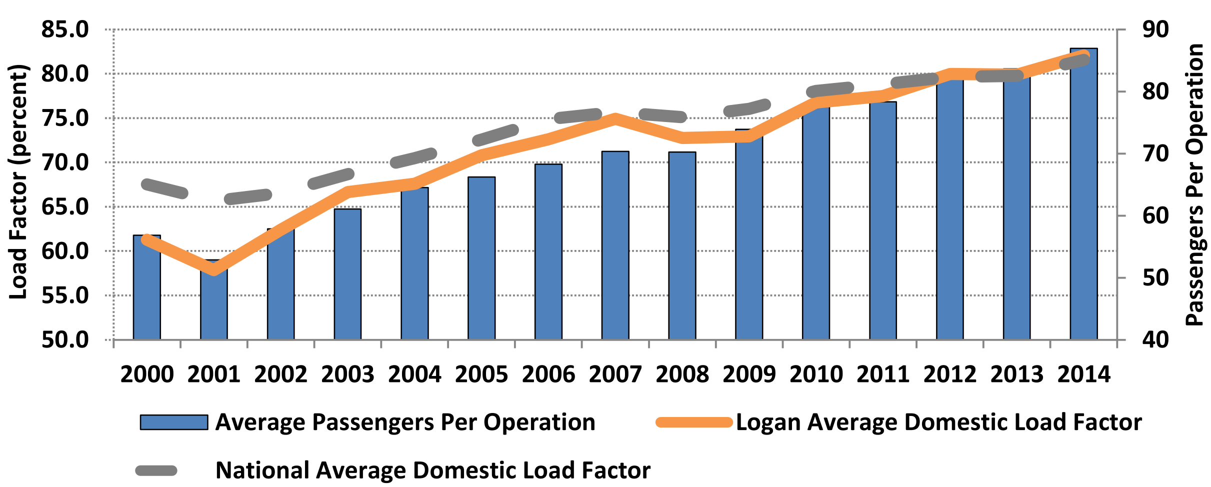
The average number of passengers per aircraft operation increased in 2014, continuing the trend seen over the past decade. An increase in the average number of passengers per aircraft operation indicates an increase in the average aircraft seating capacity and/or an increase in the percentage of aircraft seats occupied by passengers (i.e., load factor). In 2014, Logan Airport operations accommodated an average of 87 passengers per flight compared to 83.6 in 2013 (Table 2-3). The average number of passengers per flight has risen by 11.8 percent since 2010, when the average number of passengers per flight was 77.8. At Logan Airport the increasing number of passengers per flight reflects a shift away from smaller aircraft and rising load factors as airlines have retired many of the small RJs, introduced larger capacity, new generation narrow-body jets, and restricted capacity growth. In 2014, Logan Airport's average domestic load factor increased to 82.1 percent from 79.9 percent in 2013. The national average domestic load factor has also been increasing, rising from 79.8 percent in 2013 to 81.6 percent in 2014.[11] Changes in passengers per operation and load factor are shown in Figure 2-8.

Table 2-3 Air Passengers and Aircraft Operations, 2010-2014

Year	Air Passengers	Percent Change from Previous Year	Aircraft Operations	Percent Change	Average Number of Passengers per Operation	Net Change from Previous Year (No. Pass/Op.)	Logan Airport Average Domestic Load Factor	Net Change from Previous Year
2010	27,428,962	7.5%	352,643	2.1%	77.8	3.9	76.8%	3.8%
2011	28,909,267	5.4%	368,987	4.6%	78.3	0.6	77.5%	0.7%
2012	29,235,643	1.1%	354,869	(3.8%)	82.4	4.0	80.0%	2.5%
2013	30,218,631	3.4%	361,339	1.8%	83.6	1.2	79.9%	(0.1%)
2014	31,634,445	4.7%	363,797	0.7%	87.0	3.3	82.1%	2.2%

Sources: Massport; U.S. Department of Transportation (DOT), T100 Database
Notes: Numbers in parenthesis () indicate negative numbers.
Includes scheduled passenger service only.

Figure 2-8 Passengers per Aircraft Operation and Aircraft Load Factor, 2000-2014



Source: Massport.

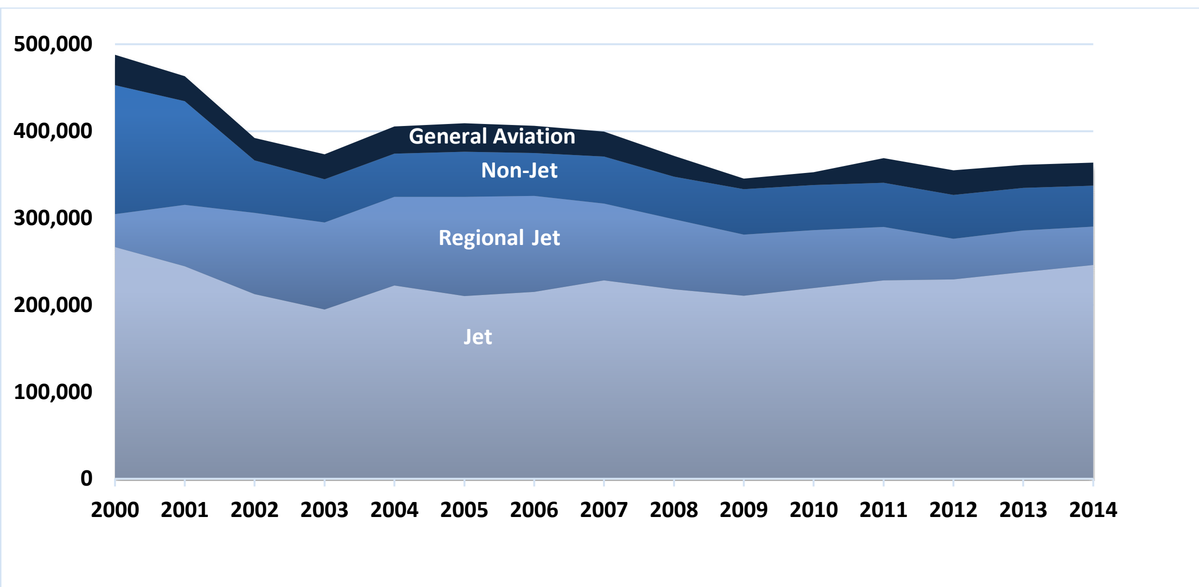
11 U.S. DOT, T100 Database.

General Aviation Operations

GA is defined as all aviation activity other than commercial airline and military operations. It encompasses a variety of aviation activities at Logan Airport including corporate/business aviation, private business jet charters, law-enforcement, and emergency medical/air ambulance services. GA operations are conducted with a diverse group of private and business aviation aircraft ranging from single-engine piston driven aircraft to high-performance, long-range jets. In 2010 to 2011, GA activity at Logan Airport showed a recovery from the steep decline during the 2008/2009 economic recession. However, GA operations have declined since 2011, as a result of economic uncertainty and sluggish economic growth. GA operations totaled 26,416 operations in 2014, down from 26,682 operations in 2013.

In 2014, GA operations accounted for 7.3 percent (26,416 operations) of aircraft activity at Logan Airport (Figure 2-4). In comparison, Hanscom Field accommodated approximately 133,700 GA operations in 2014, with GA representing 99.6 percent of Hanscom Field's aircraft activity. Hanscom Field remains the primary GA airport for the Greater Boston region, accommodating over five times the number of GA operations at Logan Airport. Figure 2-9 depicts changes in Logan Airport aircraft operations by category since 2000.

Figure 2-9 Aircraft Operations at Logan Airport by Aircraft Class, 2000-2014



Source: Massport.
Notes: Jet, regional jet, and non-jet operations are associated with commercial passenger and all-cargo airlines.
General Aviation operations also include jet and non-jet aircraft, but are associated with private charter and corporate use.

All-Cargo Operations

Operations by cargo-dedicated aircraft represent less than 2 percent of aircraft activity at Logan Airport. In 2014, all-cargo operations at Logan Airport totaled 5,711 operations, an increase of 5.7 percent compared to the prior year. Changes in all cargo aircraft operations reflect changes in demand, which is strongly linked to economic activity, and changes in the aircraft fleets of cargo airlines, which are moving to larger capacity aircraft. All-cargo carriers include FedEx, UPS, DHL, Atlas Air, and a few other small carriers.

Airline Passenger Service in 2014

Airlines can adjust service at an airport or on a specific route in two ways: changing the number of flights operated, or changing the size of the aircraft. Changes in flight frequency and changes in aircraft size both affect the number of seats available to passengers, also known as seat capacity. Airline services are therefore typically discussed in terms of seat capacity as well as the number of flight departures.[12] This section examines changes in airline departures and seat capacity at Logan Airport in 2014 and provides an overview of new and discontinued routes.

Service Developments at Logan Airport

In 2014, 32 airlines provided scheduled passenger service from Logan Airport to 115 non-stop destinations. The major changes in Logan Airport's scheduled passenger services in 2014 are described below. The average non-stop stage length (the average length of non-stop flights) of scheduled domestic flights from Logan Airport increased in 2014 to 806 miles from 793 miles in 2013. The average non-stop stage length of scheduled international flights increased from 1,768 miles in 2013 to 1,939 miles in 2014.

Changes in Domestic Passenger Service

As shown in Table 2-4, the total number of scheduled domestic flights at Logan Airport remained largely the same in 2014, increasing by 0.2 percent compared to 2013. Legacy carrier flights increased by 2.2 percent from 107,162 operations in 2013 to 109,470 operations in 2014. This marked the first year that overall legacy carrier operations have increased since 2008; past years were characterized by legacy carrier reductions related to airline consolidation or capacity cuts (due to the challenging operating environment). Total domestic LCC operations grew by 1.3 percent in 2014, increasing from 104,104 operations in 2013 to 105,384 operations in 2014. LCCs accounted for 36.1 percent of Logan Airport's total scheduled domestic operations in 2014. JetBlue Airways, the dominant LCC at Logan Airport, continued to expand, increasing its domestic operations by 3.9 percent from 73,374 operations in 2013 to 76,247 operations in 2014. JetBlue Airways' growth helped to offset continued declines in Southwest Airlines operations following its merger with AirTran Airways and the elimination of redundant services at Logan Airport. Regional commuter flights were down by 4.1 percent in 2014 due to slight reductions by Cape Air and Delta Air Lines, United Airlines and US Airways regional affiliates.

12 A departure is an aircraft take-off at an airport. While aircraft operations include both departures and arrivals, airline services are typically described in terms of departures, as the number of scheduled departures generally equals the number of scheduled arrivals. Changes in departures translate to changes in overall operations.

Table 2-4 Domestic Air Passenger Operations by Airline Category, 2010-2014

Category	2010	2011	2012	2013	2014	Percent change 2013-2014	Avg. Annual Growth (2010-2014)
Total Jet Operations	**203,081**	**207,369**	**203,376**	**211,176**	**214,854**	**1.7%**	**1.4%**
Legacy Carriers	117,877	111,761	108,374	107,162	109,470	2.2%	(1.8%)
Low-Cost Carriers	85,204	95,608	95,002	104,014	105,384	1.36%	5.5%
Regional/Commuter	**94,535**	**89,586**	**79,790**	**79,922**	**76,682**	**(4.1%)**	**(5.1%)**
Total Scheduled Domestic	**297,616**	**296,955**	**283,166**	**291,098**	**291,536**	**(0.2%)**	**(0.5%)**

Source: Massport.
Notes: LCCs serving Logan Airport in 2013 included AirTran Airways, Frontier, JetBlue Airways, Southwest Airlines, Spirit Airlines, Sun Country Airlines, and Virgin America.
Numbers in parenthesis () indicate negative numbers.

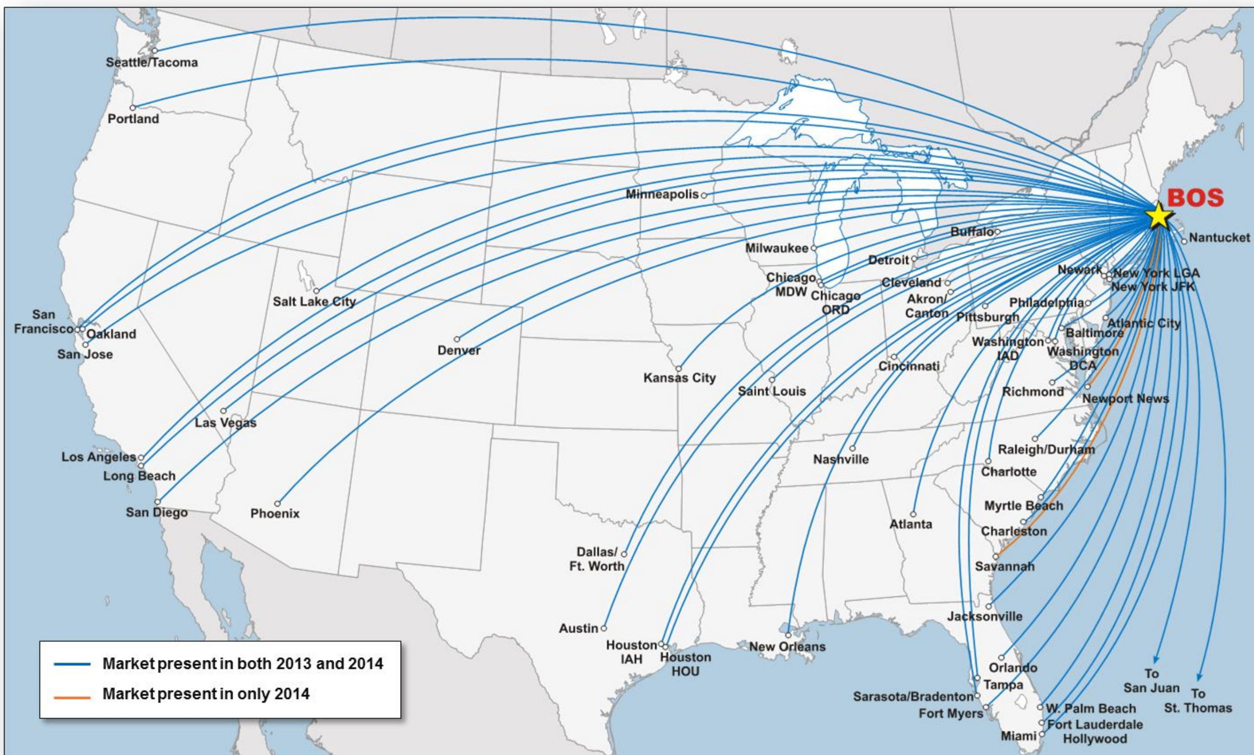
Highlights of key domestic airline service changes at Logan Airport in 2014 include:

- JetBlue Airways continued to increase its operations from Logan Airport as it progressed towards its goal of operating 150 daily departures from Logan Airport by the end of 2015. In 2014, JetBlue Airways operated up to 122 daily domestic departures from Logan Airport. New domestic destinations introduced in 2014 included Savannah and Detroit. Service levels in other markets have not changed significantly since 2013.
- With the merger of American Airlines and US Airways in December 2013, the new American Airlines became the second largest carrier, following JetBlue Airways, at Logan Airport in terms of both passengers and aircraft operations. Combined American Airlines/US Airways service levels did not change significantly in 2014, with scheduled frequencies increasing by 0.3 percent compared to the prior year. Some service reductions may still occur going forward, as the merged carrier reconciles its network at Logan Airport and eliminates any service redundancies.
- Delta Air Lines introduced new nonstop services from Logan Airport to Jacksonville (Florida), Las Vegas (seasonal), and Richmond in 2014. Seasonal nonstop service introduced to Los Angeles in 2013 was converted to year-round service in 2014. Services were discontinued to some markets including Memphis and Norfolk.
- Southwest Airlines continued to reduce services slightly at Logan Airport, as it integrated AirTran Airways into its route network. In 2014, Southwest Airlines continued to reduce service frequency in the Baltimore market and discontinued non-stop service to Orlando. In 2013, Southwest Airlines introduced new services to Houston Hobby and Kansas City.

- Budget carrier start-up, People Express Airlines, briefly operated nonstop service between its home base, Newport News, and Logan Airport in 2014. Nonstop service was introduced in June 2014, but was discontinued when the carrier ceased operations in September 2014.

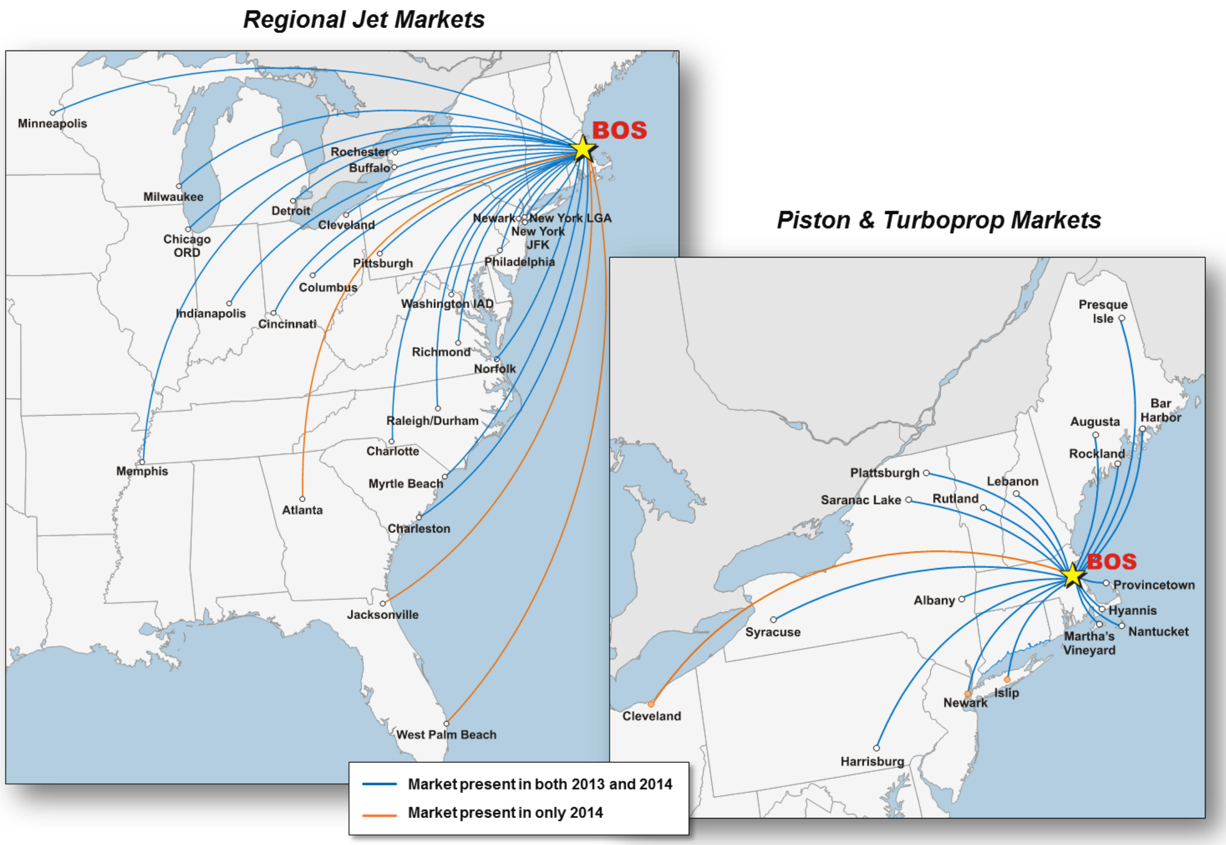
A complete listing of all changes in scheduled departures by domestic destination is in *Appendix E, Activity Levels*. Logan Airport's scheduled domestic large jet and domestic regional services in 2014 are illustrated in Figure 2-10 and Figure 2-11.

Figure 2-10 Domestic Non-stop Large Jet Markets Served from Logan Airport, July 2014



Source: Official Airline Guide.
Note: 32 airlines provided scheduled passenger service from Logan Airport to 115 non-stop destinations.

Figure 2-11 Domestic Passenger Non-stop Regional Markets Served from Logan Airport, July 2014



Source: Official Airline Guide.

Changes in International Passenger Service

Total scheduled international passenger operations at Logan Airport increased by 5.6 percent in 2014. There were approximately 39,785 annual international passenger operations at Logan Airport in 2014, up from 37,679 operations in 2013, as summarized in Table 2-5 (for details on the changes in operations by carrier, see *Appendix E, Activity Levels*).

Canada represents Logan Airport's largest international destination region in terms of aircraft operations, accounting for approximately 40 percent of total scheduled international passenger operations in 2014. In 2014, passenger operations to Canada decreased by 2.3 percent. Passenger operations to Europe, Logan's second largest international market in terms of operations and largest international market in terms of passengers, increased 2.1 percent in 2014. Operations to the Bermuda/Caribbean market increased by 5.6 percent in 2014, with some service additions introduced by JetBlue Airways and Delta Air Lines. Passenger operations to the Middle East, Asia, and Central America also increased significantly in 2014 due to new nonstop services introduced by foreign carriers. Logan Airport's scheduled international air service markets are shown in Figure 2-12.

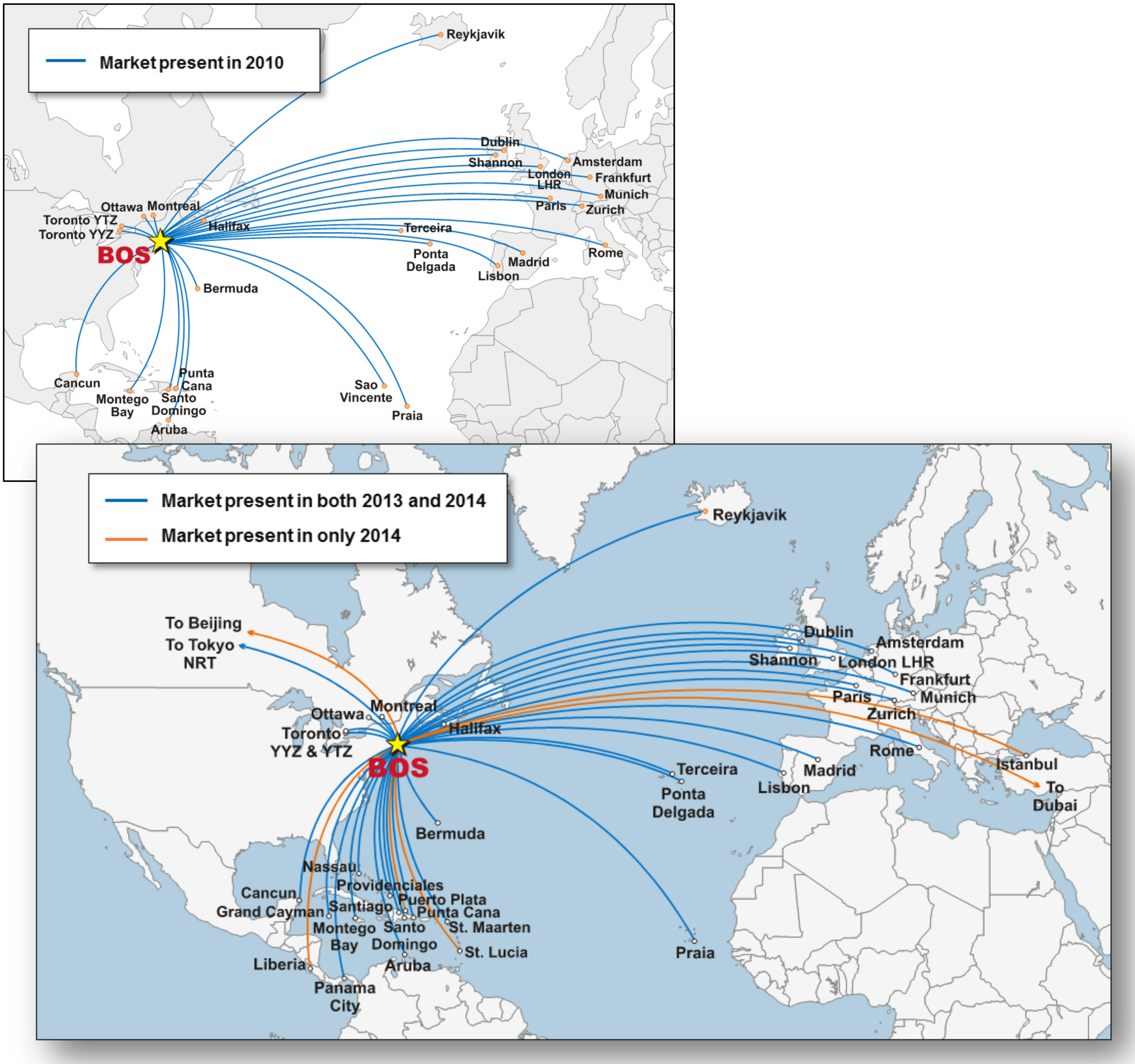
Table 2-5 International Passenger Operations by Market Segment, 2010-2014							
Category	2010	2011	2012	2013	2014	Percent change 2013-2014	Avg. Annual Growth (2010-2014)
Scheduled							
Canada	16,399	16,290	16,787	16,125	15,748	(2.3%)	(1.0%)
Europe	12,750	14,782	13,890	13,530	13,816	2.1%	2.0%
Bermuda/Caribbean[1]	4,116	6,054	6,752	7,031	7,428	5.6%	15.9%
Middle East	0	0	0	0	1,052	n/a	n/a
Asia	0	0	474	646	1,011	56.5%	n/a
Central/South America	0	0	0	347	730	110.4%	n/a
Total Scheduled International	**33,265**	**37,126**	**37,903**	**37,679**	**39,785**	**5.6%**	**4.6%**

Source: Massport.
Notes: Numbers in parenthesis () indicate negative number.
1 Includes Puerto Rico and U.S. Virgin Islands.

Logan Airport has seen a notable trend of international service increases in recent years. As shown in Table 2-5, Logan Airport gained service to Asia in 2012 with new Japan Airlines' nonstop Tokyo service. Logan Airport also gained service to Central/South America in 2013 with new Copa Airlines' Panama City nonstop service. In 2014, Logan Airport continued to attract significant new foreign carrier service and also saw continued international expansion by carriers such as JetBlue Airways and Delta Air Lines. New and expanded international passenger service at Logan Airport in 2014 included:

- In 2014, JetBlue Airways continued to expand its service offering to the Caribbean adding new nonstop seasonal service to Puerto Plata (Dominican Republic), St. Lucia, and Liberia (Costa Rica).
- Delta Air Lines introduced new seasonal service to Nassau (Bahamas) and Providenciales (Turks and Caicos Islands) in 2014. Delta Air Lines also expanded existing seasonal service to Cancún.
- In March 2014, Emirates introduced new nonstop service to its Dubai connecting hub, Logan Airport's first scheduled nonstop service to the Middle East.
- In May 2014, Turkish Airlines introduced new nonstop service to Istanbul, Logan Airport's second scheduled nonstop service to the Middle East.
- Hainan Airlines introduced new nonstop service to Beijing in June 2014, Logan Airport's second scheduled nonstop service to Asia following Japan Airlines' Tokyo Narita service launched in 2012. The Hainan Airlines service operated with next-generation Boeing 787 aircraft.
- Porter Airlines increased its service to Toronto, extending peak season service to seven daily departures in 2014.
- Aer Lingus increased its Shannon service from four times weekly in 2013 to daily in 2014.

Figure 2-12 International Non-stop Markets Served from Logan Airport, July 2014



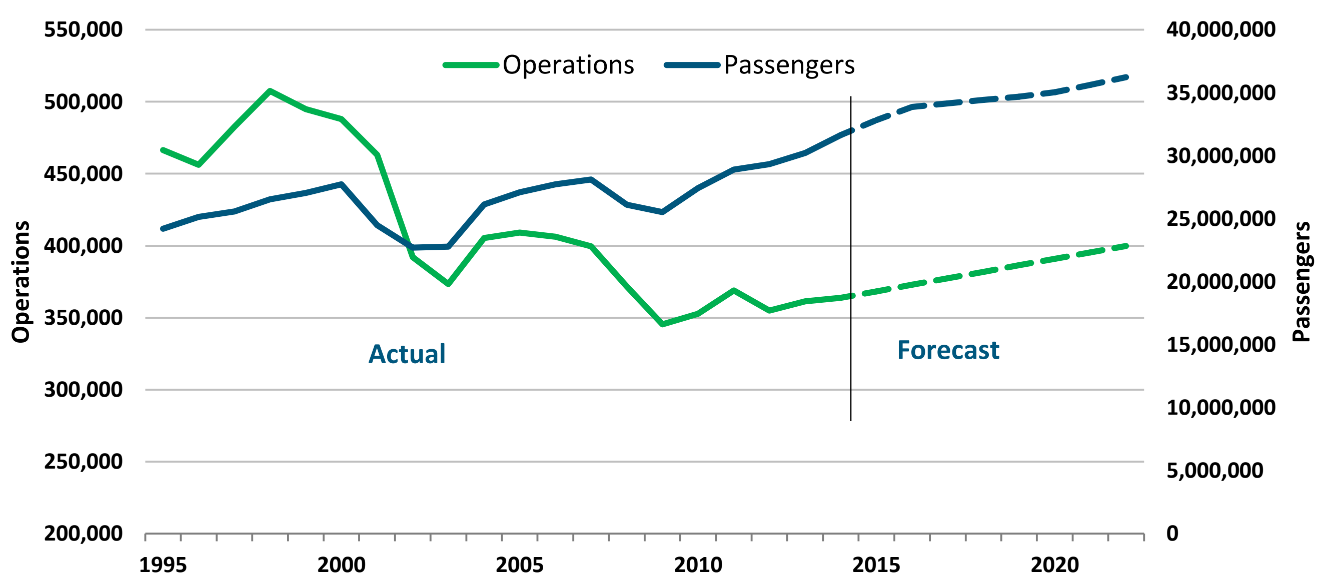
Source: Official Airline Guide Market Files.

Aviation Activity Forecasts

Logan Airport has been one of the fastest growing major U.S. airports over the last four years. A series of positive factors have combined to produce this exceptional passenger growth, and continued economic growth is the key determinant of Logan Airport's long-term passenger demand. The forecast presented in the *2011 ESPR* was updated as part of an ongoing strategic planning effort. The refined forecast reflects the most up-to-date short-term (2015 and 2016) and long-term (2035) activity outlooks. The new forecast is reflective of the recent sharp growth in traffic and service at Logan Airport, the diminished market share held by the regional airports, Massachusetts' robust short-term economic outlook, and 24 years of historical relationships to the main drivers of air transport demand at Logan Airport, including the economy, air fares, and regional share.

Demand for passenger service is determined by many external factors including economic growth, cost of travel, and demographic shifts. In the short-term, Logan Airport is projected to reach 32.9 million passengers in 2015 and 34.0 million passengers in 2016.[13] According to the medium- to long-term scenarios, Logan Airport's passenger traffic is forecast to reach 35 million annual passengers by the end of 2020. These forecasts are substantially lower than those developed in 1990, when it was anticipated that by 2010 Logan Airport would be serving between 37.5 million and 45.0 million air passengers. The forecast demand of 35 million annual passengers by 2020 reflects an assumption that aircraft operations will increase, but will remain below historic highs as airlines will deploy larger Group VI aircraft with continued high load factors (Figure 2-13).

Figure 2-13 Logan Airport Historic and Forecasted Activity Levels, 1995 - 2022



Source: Massport and InterVISTAS Forecast.

13 Massport and InterVISTAS forecast.

On the international passenger side, the dramatic rise in international travel among Boston's business and leisure passengers has helped fuel passenger growth at Logan Airport. This is consistent with Logan Airport's role of accommodating international and long-haul passenger service demand for the New England region and domestic passenger demand for greater Boston and Massachusetts. International traffic is growing at a faster rate than domestic traffic at Logan Airport (Table 2-6) with new non-stop service since 2012 to Beijing, Tokyo, Dubai, Istanbul, Israel, and Panama City. As of March 2015, Logan Airport provides nonstop service to 44 international destinations. These routes have opened New England and Boston to hubs in Asia, the Middle East, and Latin America and are expected to bring an additional $735 million in annual economic impact to Massachusetts.

Table 2-6 Forecasted Total Passengers – Domestic vs. International

Category	2014	2015	2020	2022
International (millions of passengers)	4.9	5.3	5.9	6.3
Domestic (millions of passengers)	26.5	27.6	29.1	29.9
International (percent of total)	15.8%	16.0%	17.0%	17.4%
Domestic (percent of total)	84.2%	84.0%	83.0%	82.6%

Source: Massport and InterVISTAS forecast.

Cargo Activity Levels in 2014

In 2014, Logan Airport ranked 21st among U.S. airports in total cargo volume.[14] Air cargo is carried in the belly compartments of passenger aircraft or by dedicated all-cargo carriers, including FedEx, UPS, and DHL in all-cargo aircraft. The express/small package segment dominates Logan Airport cargo activity, accounting for 62.5 percent of the total non-mail cargo volume. Table 2-7 shows all-cargo aircraft operations and cargo volumes at Logan Airport for 1990, 2000, and 2010 to 2014.

In 2014, the number of all-cargo aircraft operations at Logan Airport increased by 5.7 percent while total cargo volume, including mail, increased by 6.3 percent (Table 2-7). However, compared to 2000, all-cargo operations at Logan Airport have declined by approximately 54 percent, while total cargo volume has declined by approximately 43 percent. A number of factors are responsible for the decline in cargo shipments (including freight, express and non-express mail and packages) at Logan Airport, as well as nationally. Cargo carriers, particularly the integrators that provide door-to-door delivery services, have significantly increased their use of trucks to move cargo in shorter haul markets because it is more cost-effective than air transport. In addition, the widespread acceptance and use of the internet and e-mail has greatly reduced mail volumes overall.

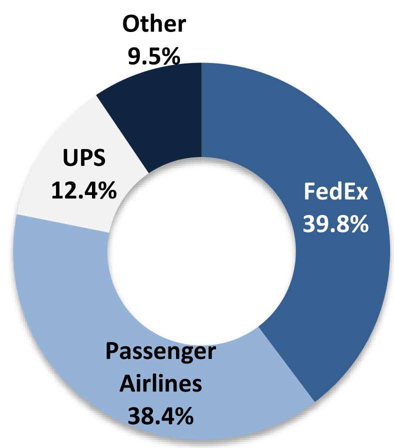
FedEx carried 39.8 percent of the total cargo volume through Logan Airport in 2014 and was the ninth largest air carrier at the Airport in terms of total flights. UPS was the next largest cargo operator and accounted for 12.4 percent of Logan Airport's cargo volume in 2014. Passenger airlines carried 38.4 percent, or 227 million pounds, of Logan Airport's cargo as belly cargo in 2014, compared to 365 million pounds that were shipped on all-cargo carriers. These numbers are presented in Figure 2-14.

14 Airports Council International, 2014 North American Air Traffic Report.

Table 2-7	Cargo and Mail Operations and Volume, 2010-2014								
	1990	2000	2010	2011	2012	2013	2014	Percent change (2013-2014)	Avg. Annual Growth (2009-2013)
All-Cargo Aircraft Operations	n/a	12,282	6,274	6,270	5,237	5,403	5,711	5.7%	(2.3%)
Volume (lbs.)									
Express/Small Packages	n/a	484,490,143	339,485,424	332,896,322	327,234,464	334,315,119	356,717,555	6.7%	1.2%
Freight	n/a	367,857,011	206,893,979	204,055,228	204,596,956	203,877,671	213,911,167	4.9%	0.8%
Mail	119,818,113	194,902,513	25,904,205	24,566,806	21,546,316	19,407,316	22,087,150	13.8%	(3.9%)
Total	**753,253,075**	**1,047,259,667**	**572,283,608**	**561,518,356**	**553,377,736**	**557,600,528**	**592,715,872**	**6.3%**	**0.9%**

Source: Massport.
Note: Numbers in parenthesis () indicate negative numbers.

Figure 2-14 Cargo Carriers – Share of Logan Airport Cargo Volume, 2014



Note: Passenger airlines carry cargo as belly cargo (in the belly of planes); Other includes Atlas Air (which flies for DHL), ABX Air, and Mountain Air Cargo.

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3

Airport Planning

Introduction

This chapter describes the status of projects underway or completed at Logan Airport by the end of 2014 and provides updates for projects underway through the filing date of this report. Specific topics include terminal area projects, service area projects, buffer/open space projects, Airport parking projects, airside area projects, high occupancy vehicle (HOV) improvements, and Airport-wide projects.

Logan Airport facilities have been accommodating recent increases in activity and operations on the airside, but the terminal, roadways, and parking facilities are strained by the increase in passengers. Following a two-year strategic planning effort, Massport is in the process of identifying priority planning projects and initiatives to accommodate the increased demand in international travel, to enhance ground access to and from the Airport, as well as improve on-Airport roadways and parking.

As discussed in *Chapter 1, Introduction/Executive Summary* of this *2014 Environmental Data Report (EDR)*, any proposed project that triggers a threshold under the Massachusetts Environmental Policy Act (MEPA) or the National Environmental Policy Act (NEPA) will undergo the appropriate project-specific state and/or federal environmental review.

2014 Planning Highlights and Key Findings

Recent progress on planning initiatives and individual projects at Logan Airport during 2014 is described below.

Airport Projects

- **Southwest Service Area (SWSA) Redevelopment Program (EEA 14137).** The Rental Car Center (RCC) project was fully operational and the full benefits of the project began to be realized in 2014. Consolidation of rental car operations and associated shuttle bus service into a single coordinated shuttle bus fleet operation resulted in customer service improvements, reduced on-Airport vehicle miles traveled (VMT) with associated emission reductions, and stormwater system enhancements. In keeping with Massport's commitment to sustainability, the Authority is proud that the RCC was awarded Logan Airport's first Gold Certification in Leadership in Energy and Environmental Design (LEED) ® in 2015. In 2010,

Logan Airport Rental Car Center.
Source: Massport.

construction began on the new RCC, and rental car and bus operations began in the centralized facility on September 25, 2013. The remaining quick-turnaround areas, permanent taxi pool, bus and limousine pools, and the SWSA edge buffers were completed in 2014. The status of mitigation efforts for the RCC is provided in *Chapter 9, Project Mitigation Tracking*.

- **Logan Airport Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R (EEA 14442).** Construction of the Runway 33L RSA improvements commenced in June 2011 and was completed ahead of schedule in November 2012. The Runway 22R RSA improvements were completed in late 2014. The status of mitigation for the RSA projects is provided in *Chapter 9, Project Mitigation Tracking*. Mitigation efforts associated with Runway 33L and Runway 22R safety improvements are ongoing.
- **Runway 15L-33R RSA Improvement.** As part of an ongoing program to improve safety at Logan Airport, and in close coordination with the Federal Aviation Administration (FAA), Massport proposed shifting existing Runway 15L-33R to accommodate an expanded RSA at the westernmost end (Runway 15L approach) of the runway. The project shifted the runway 200 feet to the southeast to comply with FAA standards requiring safety areas of 150 feet wide by 300 feet long at both ends of the runway. FAA issued a Categorical Exclusion under the National Environmental Policy Act (NEPA) on April 1, 2014. The project was completed in late 2014.
- **Renovations and Improvements at Terminal B, Pier A.** By modifying and expanding existing facilities to meet airlines' needs and providing a connection between Piers A and B, the project improves and simplifies the passenger traveling experience. The renovations included new ticket counters, a modified and enlarged passenger checkpoint, reconfigured departure lounges, concessions, new inbound and outbound baggage system, and a new airline club. The new facilities opened on April 30, 2014.
- **Logan Airport Greenway Connector Project.** The Logan Airport Greenway Connector ("Greenway Connector") is a pedestrian/bicycle path connecting the Bremen Street Park path to the future City of Boston Narrow Gauge Connector, a pedestrian/bicycle path that begins at the Greenway Overlook and continues to Constitution Beach. The Greenway Connector and the City of Boston Link provide a continuous pedestrian/bicycle path from Massport's Piers Park on the East Boston waterfront to Constitution Beach. Construction began in spring 2013 and was completed in July 2014.

Logan Airport Greenway Connector.
Source: Massport.

- **Hangar Projects.** Architectural design commenced in December 2010 for two hangar upgrades in the North Cargo Area (NCA). The renovated JetBlue Airways hangar opened in 2012. The new American Airlines

hangar, formerly occupied by Northwest Airlines, was refurbished in 2013. Demolition of the former American Airlines hangar (Hangar 16) commenced in 2014 and was completed in August 2015.

- **Parking Consolidation Project.** Massport is consolidating 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all the remaining spaces permitted under the Logan Airport Parking Freeze.[1] The West Garage addition is on the site of the existing Hilton Hotel parking lot. The project will incorporate sustainable design and resiliency elements. The consolidation commenced in spring 2015 and is expected to be completed in late 2015.
- **Terminal E Renovation and Enhancements Project.** To accommodate regular service by wider and longer Group VI aircraft at Terminal E, this project includes interior and exterior improvements. The project does not include any new gates, but will reconfigure three existing gates to accommodate Group VI aircraft (including the Airbus A380 and Boeing 747-8 primarily used by international air carriers). An addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the larger passenger loads associated with larger aircraft. The project also includes modifications to the airfield to meet required FAA safety and design standards to accommodate the larger aircraft. An Environmental Assessment (EA) was filed, and FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2015. Construction is underway.

International aircraft at Terminal E.
Source: Massport.

- **Terminal E Modernization Project.** To accommodate existing and long-range forecasted demand for international service in an efficient, environmentally sound manner that also improves customer service, Massport is planning to extend the existing International Terminal E. Modernizing Terminal E would add the three gates approved in 1996 as part of the International Gateway West Concourse project (EEA # 9791), which were never constructed, and an additional two to four additional gates in an extended concourse. The facility would be designed to function as a noise barrier. New passenger handling and passenger holdrooms are being planned, as well as possible additional Federal Inspection Services (FIS) and Customs and Border Patrol facilities to supplement the existing FIS areas in Terminal E. Previously a Satellite FIS Facility was planned and permitted in 2001 for Terminal B but never constructed (EEA # 9791). A key feature of this project is the first direct pedestrian connection from the MBTA Blue Line Airport Station to the terminal complex at Logan Airport. This project would also include improvements to Airport roadways to facilitate access. Terminal E, Logan Airport's international terminal, needs to accommodate anticipated demand. If no improvements are implemented, the passenger experience and environmental conditions will diminish. The project is in the conceptual design phase and initial construction would likely begin in 2018. Massport expects to file an Environmental Notification Form (ENF) in the very near future.
- **Landside Ground Access Operating Improvements.** A series of recent projects have been designed to yield substantial environmental benefits, particularly in the areas of ground access efficiencies and associated air quality emissions reductions on-Airport and in East Boston, as documented below.
  - The RCC reduces Airport VMT as well as improves roadway and intersection operations through: consolidating the rental car shuttle bus fleet and some Massport shuttle buses into a unified shuttle

1 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

route system resulting in the elimination of eight rental car bus fleets (a net total of 66 buses would be eliminated); intersection and roadway infrastructure improvements including signal coordination and dedicated ramp connections; and creating a Ground Transportation Operations Center (GTOC) enabling efficient planning and operation of Airport-wide transit activities.

- Logan Airport's new bus fleet, comprising 18 CNG buses and 32 clean diesel/electric buses, has fully replaced the entire fleet of diesel rental car shuttle buses now that the RCC is fully operational. Four additional new CNG buses were put into service in the summer of 2015, bringing the total to 22 buses.
- The Green Bus Depot serves as Logan Airport's on-Airport maintenance facility for Massport's new clean-fuel bus fleet. By shifting the bus maintenance operations out of the community, Massport is reducing bus traffic in East Boston and Chelsea.
- The Martin A. Coughlin Bypass reduces commercial traffic through East Boston by providing a direct link from Logan Airport's North Service Area (NSA) to Chelsea for Airport-related vehicle trips.
- The Economy Parking Garage simplified and reduced on-Airport circulation by consolidating multiple overflow parking lots throughout the Airport into a single location served by a single shuttle route. Overall traffic circulating throughout the Airport has decreased, resulting in significant operational and environmental benefits.

Planning Initiatives

- **Strategic Planning.** In 2013, Massport began a strategic planning effort to position the Authority's aviation, maritime, and real estate lines of business, and its administrative support structures and workforce to meet the region's 21st century transportation and economic development challenges. The strategic planning initiative's primary goal was to formulate a vision for Massport as a transportation and economic development engine for the Commonwealth of Massachusetts in the 21st century.
- **Resiliency Planning.** At the end of 2013, Massport initiated the Disaster and Infrastructure Resiliency Planning (DIRP) Study for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis, modeling sea-level rise and storm surge, and projections of temperature and precipitation and anticipated increases in extreme weather events. The DIRP Study will make recommendations regarding short-term adaptation strategies to make Massport's facilities more resilient to the likely effects of climate change. Massport published Flood Proofing Design Guidelines in November 2014, with a revision in April 2015.
- **Logan Airport Sustainability Management Plan (SMP).** In 2013, Massport was awarded a grant by the FAA to prepare a SMP for Logan Airport. The Logan Airport SMP planning effort began in May 2013, and was completed in April 2015. The Logan Airport SMP takes a broad view of sustainability including economic vitality, social responsibility, operational efficiency, and natural resource conservation considerations, and is intended to promote and integrate sustainability Airport-wide and to coordinate on-going sustainability efforts across the Authority. A copy of the SMP Highlights Report can be found at https://www.massport.com/environment/sustainability-management-plan/.

Table 3-1 provides a summary of the status of each planning concept, as of December 31, 2014. Descriptions are provided in subsequent sections of this chapter.

Table 3-1 Logan Airport Short- and Long-Term Planning Initiatives

		Completion	
	Status as of Dec. 31, 2014	Short-Term 2017	Long-Term 2030
Terminal Area Projects/ Planning Concepts			
Terminal E International Gateway, Phase 1 and Phase 2	C		
Terminal E, Renovations and Enhancements	D	✈	
Terminal E Modernization (incorporates three West Concourse gates previously approved but not constructed)	E		✈
Massport Satellite FIS Facility Project	E		✈
Terminal B Renovations	C		
Terminal B Walkway Extension	E		
Terminal B Garage Repair and Rehabilitation	C		
Terminal C to E Connector	D	✈	
Terminal A to B Connector	E		✈
Terminal B to C Connector	E		✈
Service Area Projects/ Planning Concepts			
Relocated CNG Station in the NCA	E		✈
Replacement Cargo Facilities in the NCA	E		✈
Replacement Hangar in the NCA	E		✈
New/Replacement GSE Consolidated Facility in the NCA	E		✈
Green Bus Depot in the NSA	C		
Flight Kitchen Consolidation in the NSA	C		
SWSA Program (Rental Car Center)	C		
Ground Transportation Operations Center	C		
NSA Roadway Corridor Project	C		
Buffer Projects/ Open Space			
SWSA Buffer (Phase 2)	C	✈	
Neptune Road Airport Edge Buffer	U	✈	
North Service Area Roadway Corridor	C	✈	
Greenway Connector	C		

		Completion	
	Status as of Dec. 31, 2014	Short-Term 2017	Long-Term 2030
Buffer Projects/ Open Space (continued)			
Navy Fuel Pier	C		
Bremen Street Park	C		
Airport Parking Projects/ Planning Concepts			
Economy Parking Project in the NCA	C		
Parking Garages Consolidation (West Garage additions and other surface locations)	U	✈	
Airside Area Projects/ Planning Concepts			
Airside Improvements Planning Project	C	✈	
Taxiway N Realignment/other taxiway improvements	E	✈	
Runways 22R and 33L Runway Safety Area Improvements	C		
Former American Airlines Hangar Demolition	U	✈	
Runway 15L-33R RSA Project	C		
Runway 4R Light Pier Replacement	E		✈
Runway Incursion Mitigation (RIM)	E		✈
Governors Island Aircraft Parking	H		✈
Airport-Wide Projects/ Planning Concepts			
Logan Airport Wayfinding System	C[1]		
Central Commissary	E		✈
Massport Strategic Plan	C		✈
Resiliency Planning	C	✈	
Logan Sustainability Management Plan	C	✈	
Joint Operations Center (JOC)	E		✈

Notes: Anticipated completion dates and status as of December 31, 2014 as denoted by ✈.
Short-term projects are anticipated to be completed by 2017 and long-term projects are anticipated to be completed by 2030.
Details of each project or planning concept are provided in the sections that follow.

C – Completed prior to or during 2014.
D – Project in design, or awaiting funding
E – Planning concepts undergoing evaluation and/or feasibility analysis
H – Project or planning concept on hold
1 – Design has been completed. At this time, the project is not funded; all Wayfinding Improvements are being achieved on a project-by-project basis.

X – Project cancelled
U – Project under construction
R – Project undergoing MEPA, NEPA/FAA, or other review

FIS – Federal Inspection Services
CNG – Compressed Natural Gas
NCA – North Cargo Area
GSE – Ground Support Equipment
NSA – North Service Area
SWSA – Southwest Service Area

Terminal Area Projects/Planning Concepts

The terminal area accommodates most of the passenger functions at Logan Airport including the passenger terminals, terminal area roadways, central parking facilities, and the Hilton Hotel. Table 3-2 presents information on the status of each ongoing terminal area project. In addition, both Massport and its tenants are proposing projects or exploring planning concepts to modernize and carry out future improvements to the existing terminal facilities. These planning concepts are also detailed in Table 3-2. The location of the ongoing terminal area projects and the planning concepts are shown on Figure 3-1.

Terminal E curbside.
Source: Massport.

Parking at Terminal E.
Source: Massport.

Figure 3-1 Location of Projects/Planning Concepts in the Terminal Area

Source: Massport.
Notes: See Table 3-2 for a description of the numbered projects. Status as of December 31, 2014.

1 International Gateway Project (Phases 1 and 2)
2 Terminal E Renovation and Enhancements
3 Terminal E Modernization (incorporates formerly proposed West Concourse)
4 Renovations and Improvements at Terminal B
5 Terminal C to E Connector
6 Terminal A to B Connector
7 Terminal B to C Connector
8 Terminal C Roadway Enhancements
9 Parking Consolidation Project (construction underway over the Hilton Hotel parking lot and at the existing surface lot between the Logan Office Center and Harborside Hyatt)

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2014)	
Description	**Status**
Massport Projects/Planning Concepts	
1. International Gateway Project (Terminal E) This project expanded and upgraded Terminal E to provide better service to international passengers. This project was constructed in phases:	
Phase 1 – A weather-protected airside bus portico linking the ground floor with the second floor to accommodate passengers arriving from remotely parked aircraft.	Completed in 2004.
Phase 2 – Expanded Federal Inspection Services (FIS) Facility, and improved meeter/greeter lobby and the ticketing area to maximize passenger convenience and reduce processing times. Includes accommodation for bicycles.	Completed in 2007.
2. Terminal E Renovation and Enhancements Project This project includes interior and exterior improvements at Terminal E to accommodate regular service by wider and longer Group VI aircraft. The project also includes airfield improvements to allow safe and efficient operations of these aircraft. The project does not include any new gates, but does include the reconfiguration of three existing gates to accommodate Group VI aircraft (including the A380 and B747-8 used by international air carriers). An approximately 94,000-square-foot addition to the west side of Terminal E will allow passenger holdrooms to be reconfigured to accommodate the passenger loads associated with larger aircraft. Additionally, interior renovations throughout the terminal are planned to enhance overall passenger service. The project also includes modifications to the airfield to meet required FAA safety and design standards. Airfield modifications include stabilizing select runway shoulders and taxiway turning areas (fillets).	Massport advanced the Terminal E Renovation and Enhancements Project that focused on upgrading three gates at Terminal E to meet Group VI aircraft requirements. This project will help meet the immediate needs to serve Group VI aircraft, without adding new gates. Planning was initiated in 2014. An Environmental Assessment (EA) was filed in July 2015 and the FAA issued a Finding of No Significant Impact (FONSI) on July 29, 2015. Construction is underway.

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2014) (Continued)

Description	Status
Massport Projects/Planning Concepts	
3. Terminal E Modernization Project (incorporates West Concourse Project) To accommodate existing and long-range forecasted demand for international service in an efficient, environmentally sound manner that also improves customer service, Massport is considering an extension of the existing International Terminal E. The modernization of Terminal E would include the three gates approved in 1996 as part of the West Concourse project, but never constructed, and could add up to two to four additional new aircraft contact gates. New passenger handling and gate areas are being considered, as well as additional FIS[1] and customs and border patrol facilities to supplement the existing FIS areas in Terminal E. A new direct passenger connection to the MBTA Blue Line Airport Station would be also be constructed and roadway improvements would be required to facilitate access.	The project is in the conceptual design phase. Massport is expecting to file an ENF with the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) in the very near future. To initiate the environmental review process under the Massachusetts Environmental Policy Act (MEPA). It is also expected that an EA would be prepared for the project to comply with FAA's review under NEPA. Following permitting and design, the initial construction could begin in 2018.
4. Renovations and Improvements at Terminal B The airline industry continues to react to financial and other operating pressures. This has led to a number of consolidations and realignments within the airlines. To address these changes and the continuing need for airlines to relocate with new partners, Massport has initiated analysis of terminal changes to better accommodate these ongoing airline partnership changes and facilitate broader flexibility in terminal utilization. This includes renovation of existing spaces, connection of the Terminal B Piers, construction of some new spaces, and reconfiguration of eight aircraft gates to better facilitate passenger processing.	Construction of the Terminal B renovations and improvements commenced in 2012 and were completed in 2014. Approximately 79,000 square feet of existing space was renovated and approximately 84,000 square feet of new space was added. Eight existing aircraft loading gates were reconfigured.
5. Terminal C to E Connector Massport is connecting Terminals C and E to provide a greater post-security connectivity between terminals and to provide greater flexibility for airlines. The project will include improvements to concessions that will further enhance the passenger experience.	The Terminal C to E Connector is under construction. Construction is expected to be completed in April 2016.
6. Terminal A to B Connector As part of an Airport-wide effort to enhance terminal connectivity post-security, a connector between Terminals A and B is under consideration.	The connector from Terminals A to B is still being considered, but this project is not currently in the five-year Capital Program. Completion would not occur until after 2017.

Table 3-2 Description and Status of Projects/Planning Concepts in the Terminal Area (December 31, 2014) (Continued)

Description	Status
Massport Projects/Planning Concepts	
7. Terminal B to C Connector Also part of the Airport-wide effort to enhance terminal connectivity post-security, a connector between Terminals B and C is under consideration.	The connector from Terminals B to C is still being considered but this project is not currently in the five year Capital Program. Completion would not occur until after 2017.
8. Terminal C Roadway Enhancements Massport is currently evaluating options to modify the layout of Terminal C on both the arrival and departure levels to alleviate congestion and better manage peak hour traffic operations.	This project is in the conceptual alternatives evaluation phase.
9. Parking Consolidation Project. Massport is consolidating 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all remaining spaces permitted under the Logan Airport Parking Freeze. The West Garage addition is atop the existing Hilton Hotel parking lot. The project will incorporate sustainable design and resiliency elements.	On March 20, 2014, the EEA issued an Advisory Opinion confirming that no MEPA review was required for this parking consolidation. The consolidation is expected to be completed in late 2015.

Notes: See Figure 3-1 for the location of terminal area projects/planning concepts.
1 Previously, a Satellite FIS Facility was planned and permitted in 2001 for Terminal B but never constructed.

Service Area Projects/Planning Concepts

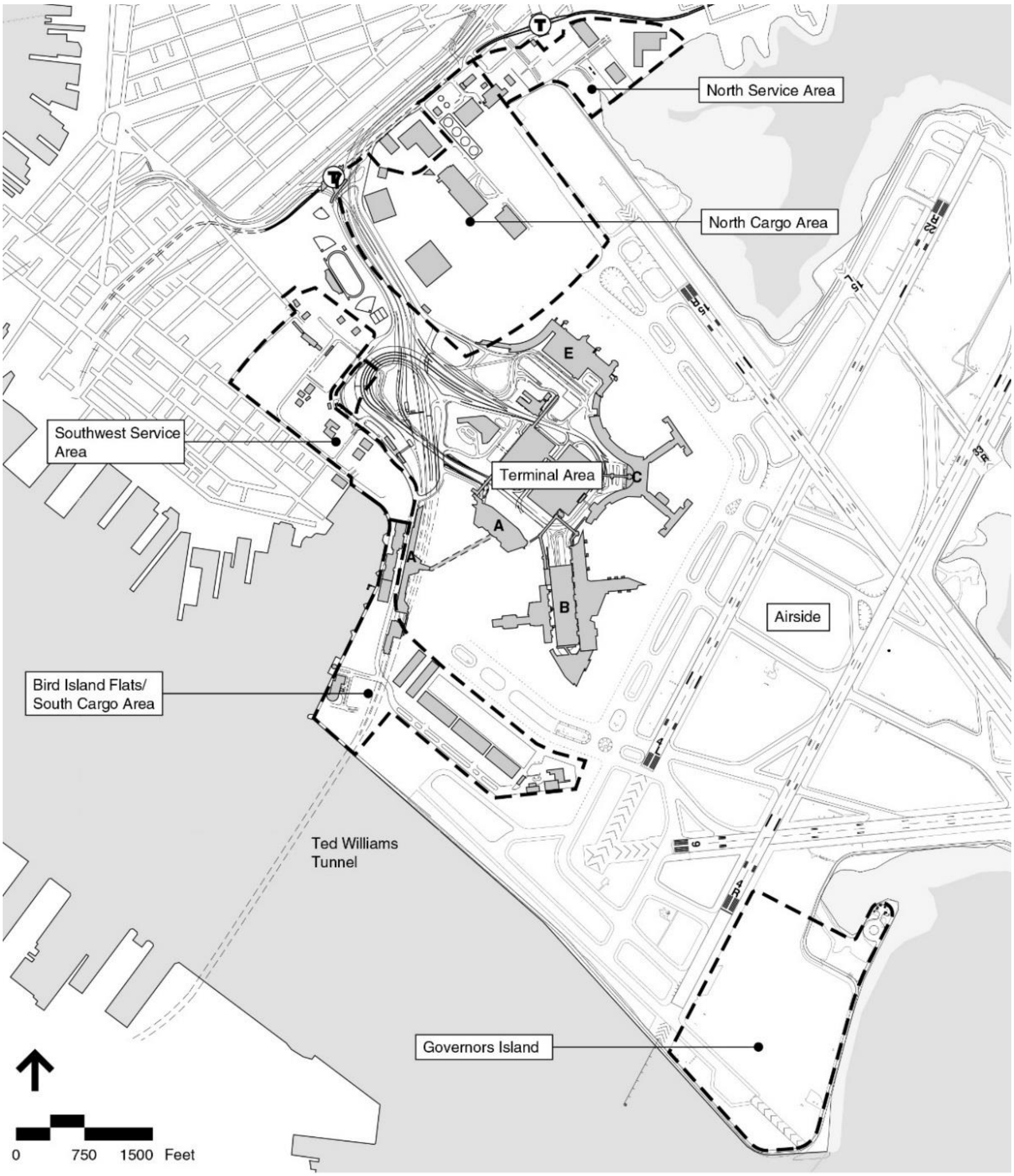
Logan Airport's service areas contain airline support businesses and operations. Land uses in the service areas continually evolve in response to changing airline business, customer, and tenant needs, as well as public works projects. Massport continues to explore ways of efficiently using the limited land resources in the service areas. The five service areas at Logan Airport are shown in Figure 3-2 and are described below.

- **North Cargo Area (NCA)** is in Logan Airport's northwest corner. It is bounded by the main Logan Airport outbound roadway to the south, Route 1A to the west, the Jet Fuel Storage Facility to the north, and the airside apron area to the east. The NCA, which is adjacent to Logan Airport's airside area, is the Airport's primary airline support area. It accommodates air cargo and essential airline support businesses including hangars, ground service equipment (GSE) maintenance, and aircraft parking. The NCA will remain the most appropriate location for operations that require contiguous airside access. The NCA is the likely location for terminal gates, aircraft parking, hangars, and cargo. In the interim, portions of the NCA will continue to be used for economy parking.
- **North Service Area (NSA)** is north of the NCA near the Massachusetts Bay Transportation Authority's (MBTA) Wood Island Station and Runway End 15R. The NSA includes two flight kitchens, weather and navigation equipment, the temporary bus/limousine pool, Neptune Road Airport edge buffer, and the Green Bus Depot. Massport recently completed the Greenway Connector running parallel to the MBTA Blue Line corridor in this section of the Airport.

- **Southwest Service Area (SWSA)** is south of Logan Airport's main access roadway and is bounded on the east by Harborside Drive. Because of its proximity to the terminals and the regional highway system, the SWSA functions as Logan Airport's primary ground transportation hub and includes the taxi and bus/limousine pools. The entire SWSA was redeveloped to accommodate the new RCC and associated activities. As an interim measure during RCC construction, the bus and limousine pools were temporarily relocated to the NSA. The taxi pool was temporarily relocated to Lot B, which is on Harborside Drive between the Logan Office Center Garage and the Hyatt Hotel. These functions returned to the SWSA in 2015.
- **Bird Island Flats/South Cargo Area (BIF/SCA)** is south and southeast of the Logan Airport's SWSA, and is generally bounded on the south by Boston Harbor and on the east and north by Logan Airport's airside area. The BIF/SCA is two service areas connected by Harborside Drive. The BIF portion has landside access via Harborside Drive and water access via the system of water taxis that shuttle passengers between downtown Boston, the South Shore, and Logan Airport. BIF development includes the Hyatt Hotel and Conference Center, the Logan Office Center and adjoining garage, an employee parking lot (Lot B), the Water Shuttle Dock, the Logan Airport Rescue and Fire Fighting Facility Marine Dock, and the Harborwalk that is a publicly accessible promenade along the harbor's edge. The SCA portion, which provides landside access and secured airside access, is Logan Airport's primary cargo area. It also accommodates domestic and some international cargo operations and temporary relocation of the taxi pool during SWSA redevelopment. During construction of the RCC project, the Lot B surface employee lot was used as the interim taxi pool. After the taxi pool was relocated to its permanent new home along Porter Street in the SWSA, Lot B was returned to its former use as an employee parking lot and commercial overflow lot.
- **Governors Island** is at Logan Airport's southern tip and is bounded by Runway 14-32 and Boston Harbor to the east and south, by Runway 4R to the west, and Runway 9 to the north. Governors Island has functioned as a storage site for the Central Artery/Tunnel (CA/T) Project and for construction stockpiles. The area also contains an Aircraft Rescue and Fire Fighting Facility training area, parking for snow removal equipment, a biocell remediation area, and FAA aircraft navigation equipment. The area has been considered as a future location of remain overnight (RON) aircraft parking.

Table 3-3 presents information on the status of each ongoing project and planning concept in the service areas. Both Massport and Logan Airport tenants are proposing projects or exploring planning concepts to modernize and carry out future improvements to the service areas. These planning concepts are also detailed in Table 3-3. The location of the ongoing service area projects and planning concepts that may potentially be constructed in the future are shown on Figure 3-3.

Figure 3-2 Logan Airport Service Areas



Source: VHB.

Figure 3-3 Location of Projects/Planning Concepts in the Service Areas

Source: Massport.
Notes: See Table 3-3 for a description of the numbered projects. Status as of December 31, 2014.
1 SWSA Redevelopment Program, RCC, and GTOC
2 Relocated Compressed Natural Gas Station in the NCA (Location TBD)
3 Replacement Cargo Facilities in the NCA (Location TBD)
4 NSA Roadway Corridor Project
5 Replacement Hangar in the NCA (Location TBD)
6 Centralized Commissary (Location TBD)
7 New/Replacement Ground Support Consolidated Facility in the NCA (Location TBD)
8 Joint Operations Center (JOC) (Location TBD)

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2014)

Description	Status
Massport Projects/Planning Concepts	
1. Southwest Service Area (SWSA) Redevelopment Program The SWSA Redevelopment Program consolidated on-Airport and most off-Airport rental car operations and facilities into one integrated facility (Rental Car Center [RCC]) to better serve tenants and the traveling public, reduce ground transportation and air quality impacts on-Airport and in the surrounding neighborhoods, and reduce associated off-Airport impacts. The program also accommodates a portion of off-Airport rental car operations. Redevelopment of the SWSA was needed because the existing SWSA and rental car facilities were inefficient and inadequate in meeting future needs at the Airport. The SWSA Redevelopment Program replaced and upgraded existing ground transportation uses within the SWSA. The redevelopment included a consolidated car rental facility with a four-level garage to accommodate rental car retail operations and storage; support facilities for the car rental operations; a new clean-fuel unified shuttle bus system; a relocated and reconfigured taxi pool; bus and limousine pool; and roadway improvements, pedestrian and bicycle facilities, and site landscaping. It also includes a customer service center and four quick turn-around maintenance and service facilities. Leadership in Energy and Environmental Design® (LEED) Gold certification was awarded in 2015. RCC construction was preceded by numerous enabling activities that reorganized the SWSA through multiple sub-phases allowing for enough of the site to be cleared for staging and construction. Some of these enabling projects included reorganization of rental car operations within the SWSA. Others included temporary relocation of ground transportation operations for a limited time, including the taxi pool to Lot B, the Cell Phone Lot to an existing open parking lot across from the Logan Airport gas station, and the bus and limousine pool to the North Service Area (NSA). The project also included the demolition of the existing flight kitchen to allow the extension of Hotel Drive. Phase 2 of the SWSA Buffer (EEA #14137) (see Table 3-5) was integrated with the proposed SWSA Redevelopment Program.	A Final Environmental Impact Report/Environmental Assessment (EIR/EA) was prepared in accordance with the Secretary of Energy and Environmental Affairs' Certificate on the Notice of Project Change (NPC). The Final EIR/EA was filed on March 1, 2010. An extended comment period closed on May 24, 2010. The Secretary's Certificate finding that the Final EIR adequately and properly complies with the Massachusetts Environmental Policy Act (MEPA) was issued on May 28, 2010. This project was completed in late 2014. A FONSI was issued by FAA on March 1, 2010. The SWSA Airport Edge Buffer was completed in late 2014.

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2014) (Continued)

Description	Status
Massport Projects/Planning Concepts	
1. Southwest Service Area (SWSA) Redevelopment Program (Continued) **Ground Transportation Operations Center (GTOC)** The new GTOC within the RCC facility functions as the hub for management of ground transportation at the Airport. GTOC staff will assume direct responsibility for: ▪ Shuttle bus management and reporting via computer-aided dispatch (CAD) and automatic vehicle location (AVL) technology; ▪ Real-time bus and transit information collection and dissemination to Airport users; and ▪ Coordination with internal and external agencies related to ground transportation. The GTOC includes a video wall to graphically display information from a variety of sources including vehicle location and status information from the CAD/AVL system, curbside camera feeds from the Consolidated Camera Surveillance System (CCSS), flight arrival and departure information from Flight Information Display System (FIDS), the status of curbside Dynamic Message Signs (DMS), emergency alerts, and other information.	Construction of the GTOC was completed in 2013 as part of the RCC project.
2. Relocated Compressed Natural Gas (CNG) Station in the North Cargo Area (NCA) This would relocate Massport's existing CNG Station to accommodate the airside operations in the NCA.	Massport continues to examine several potential on-Airport parcels for relocation of the existing CNG station. Relocation is not expected to occur before 2017.
3. Replacement Cargo Facilities in the NCA Construction of new cargo facilities in the NCA would compensate for the loss of cargo facilities that resulted from the Central Artery/Tunnel (CA/T) Project, as well as for the projected growth in cargo demand.	The project remains under evaluation. If a decision were made to proceed with this project, construction would likely commence after 2017. Hangar upgrades for Buildings 8 and 9 are complete.
4. North Service Area (NSA) Roadway Corridor Project The NSA Roadway Corridor Project coordinates the roadway and urban design vision for North Service Road and Frankfort Street with on-going design and construction efforts in the NSA. The project coordinates with the NCA Logan Airport Economy Parking Garage, East Boston- Chelsea Bypass Project, the SWSA redevelopment enabling projects, and the NSA Buffer Project to produce a unified utility, roadway, and landscape vision for the NSA roadway corridor between Prescott Street and Neptune Road.	The project was completed in 2012.

Table 3-3 Description and Status of Projects/Planning Concepts in the Service Areas (December 31, 2014) (Continued)	
Description	**Status**
Massport Projects/Planning Concepts	
5. Replacement Hangar in the NCA The former American Airlines Hangar has been demolished because it could no longer serve the American Airlines fleet. Plans are underway for a new hangar that could accommodate Group V aircraft. The location of the replacement hanger in the NCA is still under consideration.	Demolition of the former American Airlines hangar commenced in 2014, and was completed in August 2015. Prior to demolition, American Airlines relocated to the refurbished Northwest Hangar.
Tenant Projects/Planning Concepts	
6. Centralized Commissary Massport is planning for a centralized Commissary that will streamline inspection of deliveries of food, beverages, and other goods destined for the sterile areas of the Airport. The facility will allow for a centralized location for security inspections before entry and will also have the benefit of removing trucks from the terminal curbs. A location for the Commissary has not yet been determined.	Construction of the Commissary would be complete after 2017.
7. New/Replacement Ground Support Equipment (GSE) Consolidated Facility in the NCA This planning concept would provide multi-tenant maintenance facilities for GSE.	Construction would be complete after 2017.
8. Joint Operations Center (JOC). The JOC is envisioned as a state-of-the-art enterprise wide-operations and situational awareness center that consolidates Massport's complex and dispersed operations into a unified management center with a Common Operational Picture (COP). The goal of the JOC is to capture the security and response benefits afforded through integrated incident dispatch and mobile response for public safety and security services. The program plans for bringing the Operations Center, State Police Dispatch, Maritime Monitoring (with future Hanscom Field and Worcester Airport monitoring), TSA staff, and camera monitoring within the structure of one common facility. The JOC will be supported by a Physical Security Information Management (PSIM) Common Interface Platform.	Massport is in the pre-design and planning phase of development of a common command and control JOC.

Note: See Figure 3-3 for the location of service area projects/planning concepts.

Airside Area Projects/Planning Concepts

The airside area includes all Logan Airport land from the edge of the terminal buildings to the Logan Airport harbor boundary, incorporating the Logan Airport apron, runways, gates, and other airfield operating facilities. Airside improvements include upgrades and improvements to the airfield to enhance the operational efficiency and safety of Logan Airport. Table 3-4 describes the status of projects (shown on Figure 3-4) and planning concepts under consideration for Logan Airport's airside area as of December 31, 2014.

Figure 3-4 Location of Projects/Planning Concepts on the Airside

Source: Massport.
Notes: See Table 3-4 for a description of numbered projects. Status as of December 31, 2014.

1 Runway 22R and 33L RSA Improvements
2a Straightening and realignment of Taxiway N
2b Reduction in approach minimums on Runways 22L, 27, 15R, and 33L by the FAA (Operational change)
3 Replace Runway 4R Approach Light Pier
4 Governors Island Aircraft Parking
5 Runway 15L/33R RSA Improvement
6 Runway Incursion Program (RIM)
Logan Airside Improvements Planning Project (not shown on map)

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2014)

Description	Status
1. Runway 22R and 33L Runway Safety Area (RSA) Improvements The Federal Aviation Administration (FAA) requires RSAs to accommodate aircraft overruns, undershoots, and veer-offs in emergency situations. Consistent with FAA requirements, Massport is continuously looking for opportunities to increase the margin of safety for all runways and where practicable providing FAA standard RSAs at all locations. At Logan Airport, the FAA standard RSA is typically 500 feet wide by 1,000 feet long at each runway end. Where this space is not available, the FAA has approved the use of Engineered Materials Arresting System (EMAS) for aircraft overrun protection. EMAS uses a system of collapsible concrete blocks that can stop an aircraft by exerting predictable forces on the landing gear while minimizing aircraft damage. In 2004, the FAA approved installation of a 190-foot section of EMAS at Runway 22R. The FAA also directed Massport to evaluate opportunities for additional safety enhancements at this location. Massport installed a 158-foot of EMAS at Runway 33L in 2006, in anticipation of full environmental review of additional improvements. A detailed alternatives analysis was conducted to evaluate options for safety enhancements at both runway-ends. As described in the Final EA/EIR, an Inclined Safety Area (ISA) similar to what was constructed at Runway-End 22L was constructed for Runway End 22R. A pile-supported deck with EMAS approximately 460 feet long by 300 feet wide was approved for Runway End 33L.	Massport filed an Environmental Notification Form (ENF) with the Massachusetts Environmental Policy Act (MEPA) office on June 30, 2009, that described the proposed RSA enhancements at both runway ends. A Draft Environmental Assessment (EA)/ Environmental Impact Report (EIR) was filed on July 15, 2010. A Final EA/EIR was filed January 31, 2011, and the Secretary's Certificate was issued March 18, 2011. Remaining environmental permits were secured by May 2011, and construction of the 33L RSA was completed ahead of schedule in November 2012. Runway End 22R enhancements were completed in late 2014, including replacement of the EMAS installed in 2005.
Runway 33L Light Pier Replacement. The Runway 33L timber light pier was constructed in 1960 and extended to the southeast 2,400-feet from the runway end, predominantly over Boston Harbor. The Runway 33L RSA project initially proposed replacing the landward 500-feet of the light pier. During RSA construction, it was determined that the remaining 1,900-feet of the light pier should be replaced due to its advanced age and efficiencies of combining the construction with the RSA project in summer 2012 while the runway was already closed.	Massport filed a Notice of Project Change (NPC) to the RSA project in January 2012. The Secretary's Certificate was issued March 9, 2012. All local, state, and federal permits were secured for the additional work in June 2012 and the full replacement was completed in October 2012. As part of this project, the Runway 33L Instrument Landing System (ILS) approach, originally approved in the Airside Improvements Planning Project, was upgraded from Category I to Category III. Reduction in approach minimums on Runway 15R and Runway 33L was implemented in 2013 following the completion of the 33L Light Pier replacement and FAA testing of new ILS equipment.

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2014) (Continued)

Description	Status
2. Logan Airside Improvements Planning Project The project included construction of a new unidirectional Runway 14-32, Centerfield Taxiway, extension of Taxiway D, realignment of Taxiway N, improvements to the southwest corner taxiway system, relocation of cargo buildings, and reduction in approach minimums on Runways 22L, 27, 15R, and 33L. These airfield improvements were to reduce current and projected levels of aircraft delay and enhance airfield safety at Logan Airport. The new unidirectional Runway 14-32, Centerfield Taxiway, extension of Taxiway D, improvements to the southwest corner taxiway system, and relocation of cargo buildings are all complete. The remaining components of this project and status are presented below.	As part of its Record of Decision (ROD) for the Airside Improvements Planning Project under the National Environmental Policy Act (NEPA), the FAA initially deferred its decision on Centerfield Taxiway (Taxiway M) pending an operational review to identify any other potential beneficial actions. The FAA directed the technical work on the operational review and conducted briefings with a citizen panel. The FAA divided the study into two phases. Phase 1 focused on current conditions and Taxiway N, and Phase 2 included operations with both Taxiway N and the Centerfield Taxiway. Both of these Phases were completed and the public comment period on the project ended in September 2007. The FAA approved the Centerfield Taxiway in April 2007. Construction of the Centerfield Taxiway began in spring 2008 and was completed in August 2009. The Centerfield Taxiway is being used as intended by the Environmental Impact Statement (EIS) for taxiing for long-haul domestic and international flights using Runway 22L and to improve flow on the airfield and reduce taxiway congestion. Massport paved the taxiway with warm mix asphalt, which reduces energy consumption and has air quality benefits.
2a. Straightening and realigning Taxiway N. Other taxiway modifications are under consideration.	This project component is anticipated to be complete after 2017.
2b. Reduction in approach minimums on Runways 22L, 27, 15R, and 33L by FAA. (Operational change)	Reduction in approach minimums on Runways 15R and 33L was approved in the Airside EIS/EIR. Implementation will be affected by realignment of the ILS localizer. Construction impacts from relocating the Instrument Landing System (ILS) localizer were addressed as part of the proposed enhancements to the RSA at the end of Runway 33L (see above). The new Runway 33L RSA deck accommodated the relocation of the localizer. Additional navigational upgrades were installed as part of the Runway 33L Light Pier Replacement Project in 2012. Runway 33L began operating as a Category III ILS in March 2013.
3. Runway 4R Light Pier Replacement. In the next five years, Massport plans to replace the aging Runway 4R approach light pier. This will likely be a replacement of the existing wooden light pier with concrete pier/pilings.	This project is still in the early planning phase as of this filing.

Table 3-4 Description and Status of Projects/Planning Concepts on the Airside (December 31, 2014) (Continued)

Description	Status
4. Governors Island Aircraft Parking Massport has considered providing additional aircraft parking at Governors Island for the following: Remain overnight (RON) aircraft, cargo aircraft, and international aircraft. RON aircraft are generally commercial passenger aircraft that fly into the Airport at night and fly out in the morning. Airlines sometimes schedule and position more aircraft than there are gate positions, therefore remote aircraft parking positions are required. Remote aircraft parking is appropriate for cargo aircraft that generally arrive in the morning and remain on the ground until their late evening departure. Some international scheduled and charter aircraft that have long turnaround times should be parked remotely when there is a high demand for gates.	Preliminary concepts evaluated by Massport involve the development of 20 to 50 aircraft positions and ancillary uses. This project is on hold. If the concept is deemed feasible and planning continues, it is anticipated that construction would occur after 2017.
5. Runway 15L-33R RSA Improvement As part of an ongoing program to improve safety at Logan Airport, and in close coordination with the FAA, Massport proposed shifting existing Runway 15L-33R to accommodate an expanded RSA at the westernmost end (Runway 15L approach) of the runway. The project shifted the runway 200 feet to the southeast in order to comply with FAA standards requiring safety areas of 150 feet wide by 300 feet long at both ends of the runway.	FAA issued a Categorical Exclusion on April 1, 2014. The project was completed in late 2014.
6. Runway Incursion Program (RIM) FAA recently initiated a new, comprehensive multi-year Runway Incursion Management (RIM) program to identify, prioritize, and develop strategies to help airport sponsors mitigate risk. Runway incursions occur when an aircraft, vehicle, or person enters the Airport's designated area for aircraft landings and take-offs.[1] Risk factors may include unclear taxiway markings, airport signage, and more complex issues such as runway or taxiway layout.	Massport is working with the FAA to identify areas that need to be addressed and plan for implementation of measures.

Notes: See Figure 3-4 for the location of airside projects/planning concepts.
1 Information on the FAA's RIM program can be found at https://www.faa.gov/airports/special_programs/rim/.

Airport Buffer Areas and Other Open Space

Massport has committed up to $15 million for the planning, construction, and maintenance of four Airport edge buffer areas and two parks along Logan Airport's perimeter. These buffers have now been completed and include the Bayswater Buffer, Navy Fuel Pier Buffer, SWSA Buffer Phase I, and the SWSA Buffer Phase 2. Planning and design of the Neptune Road Airport Edge Buffer began in 2012, and it opened in 2015. These areas are located generally along Logan Airport's perimeter boundary and are intended to provide attractive landscape buffers between Airport operations and adjacent East Boston neighborhoods. The buffer design occurs in consultation with Logan Airport's neighbors and other interested parties in an open community planning process. To collaborate in East Boston open space planning, Massport also participates in meetings with other agencies including Massachusetts Department of Transportation (MassDOT), the City of Boston, and the Massachusetts Bay Transportation Authority (MBTA). Table 3-5 describes the status of ongoing buffer projects and other Massport green space projects under consideration as of December 2014. Figure 3-5 shows the location of these buffer projects.

Neptune Road Airport Edge Buffer.
Source: Massport.

Figure 3-5 Location of Airport Buffer Projects/Open Space

Source: Massport.
Notes: See Table 3-5 for a description of the numbered projects. Status as of December 31, 2014.

1 SWSA Buffer
2 Neptune Road Airport Edge Buffer
3 Navy Fuel Pier Buffer
4 Bayswater Embankment
5 Bremen Street Park
6 The Greenway Connector
7 North Service Area Roadway Corridor

Table 3-5 Description and Status of Airport Edge Buffer Projects/Open Space (December 31, 2014)

Description	Status
1. Southwest Service Area (SWSA) Buffer Phase 1 of this project involved the construction of an approximately half-acre area with landscaping and lighting improvements along Maverick Street that included evergreen and deciduous trees, ornamental shrubs, and groundcovers.	Phase I construction was completed in 2006.
Phase 2 of this project involved additional landscaping and solid barriers. Phase 2 consisted of installing landscaping (i.e., densely planted or planted atop earth berms for enhanced separation) and solid barriers such as fences and walls. The project enhanced bicycle and pedestrian connectivity between Maverick Street and East Boston Memorial Park and Stadium with extensive landscaping including trees, shrubs, flowering perennials, and decorative fences.	Phase 2 of the SWSA Buffer design has been integrated with the SWSA Redevelopment Program. The Secretary's Certificate on the SWSA Redevelopment Project Final Environmental Impact Report (FEIR) was issued in May 2010. Construction of the SWSA Phase 2 Buffer was completed in fall 2014.
2. Neptune Road Airport Edge Buffer The Neptune Road Airport Edge Buffer (the Neptune Road Buffer) is a Massport community mitigation project intended to buffer the East Boston Neighborhood at Logan Airport's northwestern edge. The 1.5-acre Neptune Road Buffer is at the nexus of Neptune Road, Vienna, and Frankfort Streets and is adjacent to the Massachusetts Bay Transportation (MBTA's) Wood Island Station. The majority of the parcel is located within the runway protection zone (RPZ) for Runway 15R/33L. The project consists of Olmsted-inspired landscape with various interpretive elements that will complement the adjacent North Service Area Roadway Corridor and be a continuation of the Corridor's pedestrian/bicycle path to Bennington Streets. The landscape elements reference Frederick Law Olmsted's original choice of materials and designs for Wood Island Park while preserving some of the existing trees. A pedestrian/bikeway link along Vienna Street to Bennington Street from the North Service Area Roadway Corridor was included as well as a historical timeline, cast-iron neighborhood sculptures, foundation ghosting of the last two demolished residential structures, and cast-iron house number plaques in the sidewalk along Neptune Road. Additional buffer elements include low stone walls, concrete sidewalks, bicycle racks, solar trash compactors, fencing, and period light fixtures.	The Neptune Road Buffer was completed in June 2015.
3. Navy Fuel Pier Buffer The Navy Fuel Pier Buffer project began with the Army Corps of Engineers' (ACOE) remediation of the former Navy Fuel Pier, which was completed in 2001. The project involved beautification of the property (0.7 acres) through landscape improvements and stabilization of the waterfront perimeter.	Construction of the buffer was completed in 2007.
4. Bayswater Embankment This project involved creation of a landscaped buffer between Bayswater Street and Boston Harbor.	Construction of this Airport edge buffer was completed in 2003.

Table 3-5 Description and Status of Airport Edge Buffer Projects/Open Space (December 31, 2014) (Continued)	
Description	**Status**
5. Bremen Street Park The 18-acre Bremen Street Park was constructed by the Central Artery/Tunnel (CA/T) Project as East Boston's second largest neighborhood park. The park contains a variety of facilities, a direct pedestrian connection to MBTA Blue Line Airport Station, and a half-mile segment of the three-mile East Boston Greenway. The park was built on land previously used as off-Airport parking.	Final construction of the park was completed in 2008. Massport continues to operate the park and provide community facilities.
6. The Greenway Connector The one-half mile pedestrian/bicycle path connects the Bremen Street Park pedestrian/bicycle path to the future City of Boston/ Narrow Gauge (currently in final planning phase) Connector to Constitution Beach. When completed there will be a continuous pedestrian/bicycle path from Piers Park to Constitution Beach that will connect Piers Park, Bremen Street Park, Stadium Park, and Constitution Beach.	Construction of the Greenway Connector between Bremen Street Park and an Overlook at Wood Island Marsh was completed by Massport in 2014. Massport continues to coordinate with the City of Boston on its pedestrian/bicycle path, known as the "Narrow Gauge Connecter," from the Overlook to Constitution Beach.
7. North Service Area (NSA) Roadway Corridor The North Service Area Corridor Project (the NSA Corridor) is an approximately 7-acre project that created a unified streetscape, landscape context, and pedestrian/bicycle path connection for the future Neptune Road Airport Edge Buffer at Logan Airport's northwestern edge. The project encompasses various parcels along Airport Service Road that parallel an elevated section of Route 1A Highway. Cognizant of the importance of establishing a public space along Logan Airport's northwestern edge, Massport restored and relocated WindWheels, an important William Wainwright mobile sculpture and Massport's first piece of public art, to a prominent location at the Corridor's Neptune Road entrance.	Massport completed construction of the project in spring 2012 and has committed to the ongoing maintenance of the NSA Corridor.

Note: See Figure 3-5 for the location of Airport edge buffer projects/planning concepts.

Airport Parking Projects/Planning Concepts

The total number of employee and commercial parking spaces permitted at Logan Airport is limited by the Logan Airport Parking Freeze under the State Implementation Plan (SIP) and the MassDEP air quality regulations (310 Code of Massachusetts Regulations 7.30). Parking supply at Logan Airport has varied with respect to the specific locations and sizes of individual lots, the mix of parking spaces for air travelers and employee spaces, and the number of spaces in and out of service at any one time due to construction projects, while at all times remaining in compliance with the Logan Airport Parking Freeze. *Chapter 5, Ground Access to and from Logan Airport* contains additional information on the historic and existing supply of parking at Logan Airport. Table 3-6 describes current commercial parking projects at Logan Airport. The locations of parking projects are shown on Figure 3-6.

Figure 3-6 Location of Airport Parking Projects/Planning Concepts

Source: Massport.
Notes: See Table 3-6 for a description and status of numbered projects. Status as of December 31, 2014.
1 Parking Consolidation Project (construction underway over the Hilton Hotel lot and at the existing surface lot between the LOC and the Harborside Hyatt).

Table 3-6 Description and Status of Airport Parking Projects/Planning Concepts (December 31, 2014)

Description	Status
1. **Parking Consolidation Project.** Massport is consolidating 2,050 temporary parking spaces as an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all remaining spaces under the Logan Airport Parking Freeze. The West Garage addition is atop the existing Hilton Hotel parking lot. The project will incorporate sustainable design and resiliency elements.	The consolidation project is underway and construction is expected to be completed in 2015. On March 20, 2014, the EEA issued an Advisory Opinion confirming that no MEPA review was required for the consolidation of existing on-Airport parking spaces.

Note: See Figure 3-6 for the location of Airport parking projects/planning concepts.

Massport-wide Projects and Plans

Massport is undertaking several Massport-wide planning initiatives including:

- **Strategic Plan.** In 2013, Massport began a strategic planning effort to position the Authority's aviation, maritime, and real estate lines of business, and its administrative support structures and workforce to meet the region's 21st century transportation and economic development challenges. The strategic planning initiative's primary goal was to formulate a vision for Massport as a transportation and economic development engine for the Commonwealth of Massachusetts in the 21st century focusing on the horizon years of 2022 and beyond. While Massport has periodically prepared and implemented strategic plans for its various lines of business and major assets, the most recent effort is the first time that Massport has ever prepared an Authority-wide strategic plan. One outcome of this effort is Massport's updated vision: *A world class organization of people moving people and goods – and connecting Massachusetts and New England to the world – safely and securely and with a commitment to our neighboring communities.*

  During this process, the importance of viewing the Authority as a single consolidated entity has become clear: Massport's transportation and economic assets have a synergistic impact on many key sectors of the regional economy. Boston's knowledge economy benefits simultaneously from Logan Airport's growing network of international destinations, Hanscom Field's general aviation (GA) facilities used by major corporations, and Real Estate development on Massport properties in the South Boston Waterfront. Through the "One Massport" lens, Massport's critical role in the region's visitor economy becomes clear.

  - Over 31.6 million passengers traveled through Logan International Airport in 2014.
  - Since JetBlue initiated commercial flights at the Worcester Regional Airport in late 2013, nearly 200,000 passengers have used this convenient service.
  - Hanscom Field continues to serve as the region's premier corporate and business aviation facility and serves as a critical GA reliever for Logan Airport. In 2014, Hanscom Field handled more than five times the number of GA operations than occurred at Logan Airport.
  - Nearly 350,000 vacationers now use Cruiseport Boston annually.
  - In 2014, the Conley Terminal handled a record 214,243 TEUs (twenty-ton equivalent units).

The strategic planning analysis has identified several strategic challenges for Massport's three airports. At Logan Airport, passengers are up, but flights are down; the increase in passengers will continue to result in pressure points on terminal and landside facilities. The focus of the Worcester Regional Airport will be to provide commercial air service and premier general aviation services to the greater Worcester region; Massport and its tenants are already advancing projects to improve the Airport's all-weather reliability and to create a new first-class Fixed Based Operator (FBO) facility. Hanscom Field is envisioned to remain as the premier corporate and business aviation facility for the Boston and New England region and will also remain as a commercial/general aviation and limited cargo facility.

Ground access at Logan Airport will continue to face strategic challenges as we strive to minimize the traffic, environmental, and community impacts of surface transportation while providing air passengers and our employees with as many options as possible for convenient travel to and from the Airport. To meet these challenges, Massport's overarching ground access goal is to minimize the number of motor vehicles used traveling to and from Logan Airport.

The findings of this effort were presented to the Massport Board in late 2014 and sets the direction for future investments and plans at Logan Airport.

- **Resiliency Planning.** At the end of 2013, Massport initiated a Disaster and Infrastructure Resiliency Planning Study (DIRP) for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston. The DIRP Study includes a hazard analysis, modeling sea-level rise and storm surge, and projections of temperature and precipitation and anticipated increases in extreme weather events. The DIRP Study provides recommendations regarding short-term adaptation strategies to make Massport's facilities more resilient to the likely effects of climate change. The study was completed and a request for proposals for implementing its recommendations was issued in September 2014; work commenced in late 2014.

  In addition to the DIRP Study and its related initiatives, Massport has completed an Authority-wide risk assessment, as part of its strategic planning initiative; issued its Floodproofing Design Guide; and has developed a resilience framework that will provide consistent metrics for the short- and long-term resilience of its critical facilities and infrastructure. Beyond physical resiliency, Massport is also focused on incorporating social and economic resilience into its long-term operational and capital planning. Massport's Floodproofing Guidelines were published in November 2014 and revised in April 2015.

- **Sustainability Management Plan (SMP).** The purpose of the Logan Airport SMP is to enhance the efficiency and sustainability of Logan Airport's operations and to support the broader sustainability principles of the Commonwealth. In 2013, Massport was awarded a grant by the FAA to prepare a SMP for Logan Airport. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The Logan Airport SMP takes a broad view of sustainability including economic vitality, social responsibility, operational efficiency, and natural resource conservation considerations. The Logan Airport SMP is intended to promote and integrate sustainability Airport-wide and to coordinate on-going sustainability efforts across the Authority. A baseline data assessment was completed in winter 2014 to assess current sustainability performance at the Airport. The Logan Airport SMP developed a framework and implementation plan, with metrics and targets, designed to track progress over time. Massport is currently advancing a series of short-term initiatives to help reach its goals in the areas of energy and greenhouse gas emissions; community, employee, and passenger well-being; resiliency; materials waste management, and recycling; and water conservation. The Logan Airport SMP is available online at: https://www.massport.com/media/320786/LoganSMP_Report.pdf.

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4

Regional Transportation

Introduction

This chapter places Logan Airport in the context of the New England region's intermodal transportation system and reports on the status of the region's airports in 2014. Logan Airport, one of three airports[1] owned by the Massachusetts Port Authority (Massport), operates within a larger network of New England regional airports. Massport has committed ongoing efforts to support an efficient regional air and surface transportation network. Current air traffic levels and airline service trends at the New England regional airports are discussed in this chapter. Airport improvement projects and long-range regional transportation planning efforts relevant to the regional transportation network are also discussed. This chapter focuses on 2014 and specifically describes:

- Passenger and aircraft activity levels at New England regional airports including:
  - Bradley International Airport, CT;
  - T.F. Green Airport, RI;
  - Manchester-Boston Regional Airport, NH;
  - Portland International Jetport, ME;
  - Burlington International Airport, VT;
  - Bangor International Airport, ME;
  - Tweed-New Haven Airport, CT;
  - Portsmouth International Airport at Pease, NH;
  - Worcester Regional Airport, MA; and
  - Hanscom Field, MA.
- Changes in airline service levels and other factors that have contributed to trends in regional airport activity.
- The status of current improvement plans and projects at the regional airports.
- Massport's initiatives and joint efforts with other transportation agencies to improve the efficiency of the New England regional transportation system.
- Regional long-range transportation planning efforts.

1 Massport owns and operates Boston-Logan International Airport, Hanscom Field, and Worcester Regional Airport.

2014 Regional Transportation Highlights and Key Findings

Key findings for New England regional airports, the regional transportation system in 2014, and status updates for long-range planning efforts include:

- The New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever, and general aviation (GA) airports[2] (regional airports). Together, these 11 airports accommodate nearly all of New England's air travel demand. Logan Airport serves as a major domestic origin and destination market and acts as the primary international gateway for the region. The region is also served by rail service (provided by Amtrak) which connects Boston to the New York/Washington D.C. metropolitan areas to the south and Portland, ME to the north.
- In 2014, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased by 3.1 percent from 45.4 million in 2013 to 46.8 million annual air passengers in 2014. The increase in the region's passenger traffic was largely driven by continued growth at Logan Airport. Among the other regional airports, Bradley International Airport and Worcester Regional Airport also saw some increase in passenger traffic. Passenger levels at the majority of other regional airports remained flat or continued to decline due to continued airline service reductions in 2014. Due to a slow and uneven recovery in the economy following the recession in 2008/2009 and volatile fuel prices, U.S. airlines have continued to face a challenging operating environment. Airlines have attempted to maintain tighter capacity control, which has resulted in ongoing service cuts at various secondary and tertiary airports across the nation. In 2014, total passenger traffic at the regional airports excluding Logan Airport decreased by 0.1 percent from the previous year, while passenger traffic at Logan Airport increased by 4.7 percent. Overall passenger growth in the New England region tracked closely to the overall U.S. passenger market, which saw an average increase of 3.1 percent in 2014.[3]
- Passenger traffic at the New England airports in 2014 represented the highest passenger traffic level for the region since the economic downturn in 2008. However, passenger traffic in the region has yet to return to the peak 2005 to 2007 levels, which exceeded 47.0 million. In comparison, U.S. passenger traffic reached a record high in 2014, exceeding the previous national peak in 2007.
- Of the 46.8 million passengers using New England's commercial service airports in 2014, 67.6 percent of passengers (31.6 million) used Logan Airport compared to 66.6 percent (30.2 million) in 2013. Despite the recent increases in Logan Airport's regional share, it remains below the regional peak of 73 percent in 1985.[4]
- Worcester Regional Airport, offering recently-launched JetBlue Airways service to Orlando and Fort Lauderdale, handled approximately 116,700 passengers[5] in 2014. Aircraft load factors were consistently over 80 percent. A new, state-of-the-art, corporate hangar facility is under construction. For aircraft arriving and departing in low visibility conditions, Massport has begun the environmental and design process for construction of a Category (CAT) III approach system.

2 The New England Regional Airports Air Passenger Service Study (Federal Aviation Administration, 1995) defined the Bradley International, T.F. Green, Manchester-Boston Regional, Portland International Jetport, Bangor, Burlington, Worcester Regional, and Tweed-New Haven Airports as the region's principal commercial airports, other than Logan Airport, since all of these airports either supported or had previously supported commercial jet passenger services. Subsequently, in 1999, limited commercial passenger service was introduced at Hanscom Field and at Portsmouth International Airport, though neither airport has been able to sustain commercial airline services over the long-term. These 11 airports are included in the New England Regional Airport System Plan Study, which was published in 2006.
3 Based on U.S. DOT, Bureau of Transportation Statistics for scheduled passenger traffic.
4 Based on airport passenger statistics from 1985 to 2013.
5 Based on Worcester Airport Records; includes JetBlue Airways passengers and a small number of charter passengers.

- Aircraft operations activity levels have declined significantly throughout the region since 2000, as part of an ongoing trend of higher aircraft load factors, larger aircraft size, and reduced service levels. Total aircraft operations in the region have declined from 1.6 million in 2000 to 972,723 in 2014.
- Aircraft operations in the New England region decreased by 4.3 percent in 2014, from 1.02 million operations in 2013 to 972,723 operations in 2014. Driven by declines at Hanscom Field, regional GA operations showed the largest decline in 2014, decreasing by 11.7 percent (46,940 operations). Although military operations decreased by 3.0 percent (950 operations) in 2014, commercial airline operations in the region increased slightly by 0.4 percent (2,320 operations) overall.
- Massport continued to engage in metropolitan cooperative planning efforts including MassDOT's GreenDOT initiative, the Healthy Transportation Compact,[6,7] the South Boston Waterfront Transportation Plan, and the Boston Metropolitan Planning Organization (Boston MPO).
- Massport is cooperating with MassDOT's efforts to expand Boston's South Station to meet the current and future demand for rail mobility within Massachusetts and along the Northeast Corridor.
- Massport participates with the MassDOT, the City of Boston, and the Massachusetts Convention Center Authority to advance the improvements listed in the South Boston Waterfront Transportation Plan.
- MassDOT and the other New England state transportation agencies collaborated with the Federal Aviation Administration (FAA) on the *New England Regional Airport System Plan – General Aviation* study to provide an understanding of general aviation airports, infrastructure and capital needs for the New England region.

New England Regional Airport System

As shown in Figure 4-1, the New England region is anchored by Logan Airport and a system of 10 other commercial service, reliever and GA airports (regional airports).[8] Together, these 11 airports accommodate nearly all of New England's air travel demand. Logan Airport serves a major domestic origin and destination market and acts as the primary international gateway for the region. The regional airports range in role and activity levels from Bradley International Airport, which served close to 6 million commercial passengers in 2014, to Hanscom Field, which does not currently handle any commercial or charter flights but serves as New England's largest GA facility.

6 Massachusetts Department of Transportation, www.eot.state.ma.us/default.asp?pgid=content/releases/pr060210_GreenDOT&sid=release, June 2, 2010.
7 Massachusetts Department of Transportation, www.massdot.state.ma.us/main/healthytransportationcompact.aspx.
8 The New England Regional Airports Air Passenger Service Study (FAA, 1995) defined the Bradley International, T.F. Green, Manchester, Portland International Jetport, Bangor, Burlington, Worcester Regional and Tweed-New Haven Airports as the region's principal commercial airports, other than Logan Airport, since all of these airports either supported or had previously supported commercial jet passenger services. Subsequently, in 1999, limited commercial passenger service was introduced at Hanscom Field and at Portsmouth International Airport, though neither airport has been able to sustain commercial airline services over the long-term. These 11 airports are included in the New England Regional Airport System Plan (NERASP) Study, which was published in 2006.

Figure 4-1 New England Regional Transportation System

Massport owns and operates two of the regional airports, Hanscom Field and Worcester Regional Airport. Both of these airports play important roles in the New England regional transportation system, as described below.

- Worcester Regional Airport (ORH) is located in central Massachusetts, approximately 50 miles west of Logan Airport. Worcester Regional Airport is recognized as an important aviation resource that can accommodate both corporate GA activity and commercial airline services. Massport assumed operation of Worcester Regional Airport in 2000 and later acquired the Airport from the City of Worcester in June 2010. Aircraft operations at Worcester Regional Airport totaled approximately 32,000 operations in 2014, with GA accounting for close to 90 percent of aircraft activity. Allegiant Air served the Airport for only nine months in 2009 and Direct Air served Worcester Regional Airport from November 2008 to March 2012, shortly

before the carrier filed for bankruptcy. After the cessation of Direct Air's services, Massport, in conjunction with the City of Worcester and other community stakeholders, actively promoted the reintroduction of scheduled airline service at the airport and successfully secured new services from JetBlue Airways. On November 7, 2013, JetBlue Airways commenced non-stop services to Orlando International and Fort Lauderdale-Hollywood airports using 100-seat Embraer 190 aircraft. This service has proven to be highly popular, with JetBlue Airways realizing consistently high load factors (85 percent on average) and handling over 115,000 passengers in 2014.

- Hanscom Field (BED) is a full-service GA airport that accommodates a wide variety of GA activities, including corporate aviation, private flying, commuter air services, as well as some charters and light cargo. Located in Bedford, MA, approximately 20 miles northwest of Logan Airport, Hanscom Field is New England's premier facility for business/corporate aviation and serves a critical role as a GA reliever airport for Logan Airport. In 2014, Hanscom Field accommodated approximately 133,700 GA operations, more than five times the number of GA operations that occurred at Logan Airport. Consistent with its role as a premier corporate airport, new hangars are being built to accommodate the need for corporate jet services. In addition to its role as a GA facility, Hanscom Field has also accommodated niche commercial airline services in the past.

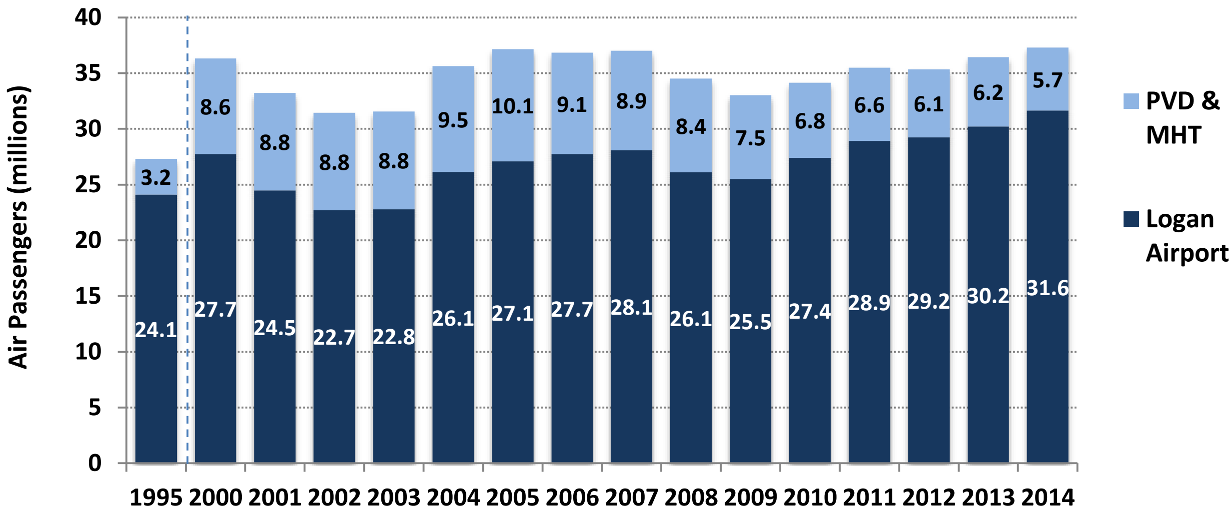
Apart from Hanscom Field and Worcester Regional Airport, the regional airports closest to Logan Airport are T.F. Green Airport (PVD) in Warwick, RI and Manchester-Boston Regional Airport (MHT) in Manchester, NH. Because of their proximity to Logan Airport and overlapping market areas, these airports may be convenient choices for some passengers in the Greater Boston Area. The New England Regional Airport System Plan (NERASP) Study, which was published in 2006, identified a high degree of cross-airport utilization within the Greater Boston airport system, which encompasses Logan Airport, T.F. Green Airport, and Manchester-Boston Regional Airport. In effect, the three airports act as a system of airports, with significant numbers of passengers choosing the most convenient airport in terms of access, airfares, and available air services depending on their individual air travel needs. [9]

Prior to 2005, the Central Artery/Tunnel (CA/T) construction project and high fares made Logan Airport less attractive for many air travelers in the Greater Boston area. Many passengers viewed T.F. Green Airport and Manchester-Boston Regional Airport as convenient alternatives to Logan Airport. After the introduction of low-cost services on Southwest Airlines, these two airports captured an increasing share of the Greater Boston market. However, with the completion of major portions of the CA/T project in 2004, as well as JetBlue Airways' entry and expansion at Logan Airport, the Airport began to recapture passengers from its core service area that were previously using the regional airports.

Logan Airport is well-positioned in terms of access and competitive airfares, and available air services to meet the demands of the core Boston passenger market. Passenger traffic at T.F. Green Airport and Manchester-Boston Regional Airport peaked in 2005, and declined significantly in recent years due to an industry-wide trend of airline service reductions at smaller airports. However, T.F. Green Airport and Manchester-Boston Regional Airport remain well situated to serve their own catchment areas and continue to accommodate considerably more passengers than before the entry of Southwest Airlines in the late 1990s. In 2014, T.F. Green and Manchester-Boston Regional Airports' share of the combined Greater Boston passenger market continued the declining trend from recent years. In 2014, the two airports served 15 percent (5.7 million) of the combined passengers at the three main commercial airports serving the Greater Boston area, down from 17 percent (6.2 million) in 2013 and a high share of 28 percent (8.8 million) in 2002. Figure 4-2 depicts the historical distribution of air passengers for Logan Airport, T.F. Green Airport, and Manchester-Boston Regional Airport.

9 *New England Regional Airport System Plan*, Federal Aviation Administration, 2006.

Figure 4-2 Passenger Activity Levels at Logan Airport and T.F. Green (PVD) and Manchester-Boston Regional (MHT) Airports, 1995-2014



Source: Massport and individual airport data reports.

In addition to Logan Airport and the regional airports discussed above, a third tier of airports serves relatively isolated communities or provides niche commercial airline services in New England. These airports include: Hyannis Airport, Martha's Vineyard Airport, Nantucket Memorial Airport, New Bedford Regional Airport, and Provincetown Municipal Airport in MA; Augusta State Airport, Bar Harbor Airport, Rockland Airport, and Northern Maine Regional Airport in ME; Lebanon Municipal Airport in NH; Block Island State Airport and Westerly State Airport in RI; and Rutland Southern Vermont Regional Airport in VT. The third-tier airports support frequent commercial service to Logan Airport and, in some instances, T.F. Green Airport during the summer months. Most of these third-tier airports are not in close proximity to Logan Airport and are isolated due to geographic factors. Because of their remoteness and/or limited market areas, many of these airports are unlikely to attract passengers that now fly from Logan Airport. Instead, many of these airports are dependent on Logan Airport for connecting services.

Air Passenger Trends

The following section provides an overview of air passenger trends for the regional airports over the last decade.

Regional Airport Passengers

In 2014, New England's 11 commercial airports accommodated 46.8 million passengers. As shown in Table 4-1, total air passenger traffic at the New England airports increased by 3.1 percent in 2014, up from 45.4 million in 2013. Passenger traffic at the New England airports in 2014 represented the highest passenger traffic level for the region since the economic downturn in 2008. However, passenger levels in the region have yet to return to the peak 2005 to 2007 levels, which exceeded 47.0 million. Passenger traffic growth in the New England region

tracked closely with overall growth in the U.S. passenger market, which increased by 3.1 percent in 2014.[10] In comparison, U.S. passenger traffic reached a record high in 2014, exceeding the previous peak in 2007.

Passenger traffic increases at Logan Airport in 2014 helped to offset continued declines at a number of the regional airports. In 2014, air passengers at Logan Airport grew by 1.4 million or 4.7 percent over the prior year. Overall passenger traffic at the regional airports excluding Logan Airport declined slightly by approximately 13,000 passengers or 0.1 percent compared to 2013. The 10 regional airports accounted for a total of 15.16 million passengers in 2014, compared to 15.17 million passengers in 2013. Consequently, the ten regional airports' share of New England passengers decreased to 32.4 percent in 2014, compared to 33.4 percent in 2013 (Figure 4-3). The decline in passenger traffic at the regional airports reflects the volatile operating environment facing U.S. airlines and is consistent with the national trend at secondary and tertiary airports. The global economic downturn that began in 2008 resulted in a drop in passenger demand and widespread airline capacity reductions, particularly at the smaller regional airports. Airlines eliminated less profitable routes, cut frequencies in smaller markets, and reduced flying with small regional jets (RJs), which had become uneconomical to operate with sustained high fuel prices. Airlines have remained conservative with growth plans and have not increased overall capacity significantly at the regional airports as of 2014. Despite the recent declines in regional airport passengers, the regional airports continue to accommodate a significant share of the region's passengers, up substantially from their share of 27.0 percent in 1985.

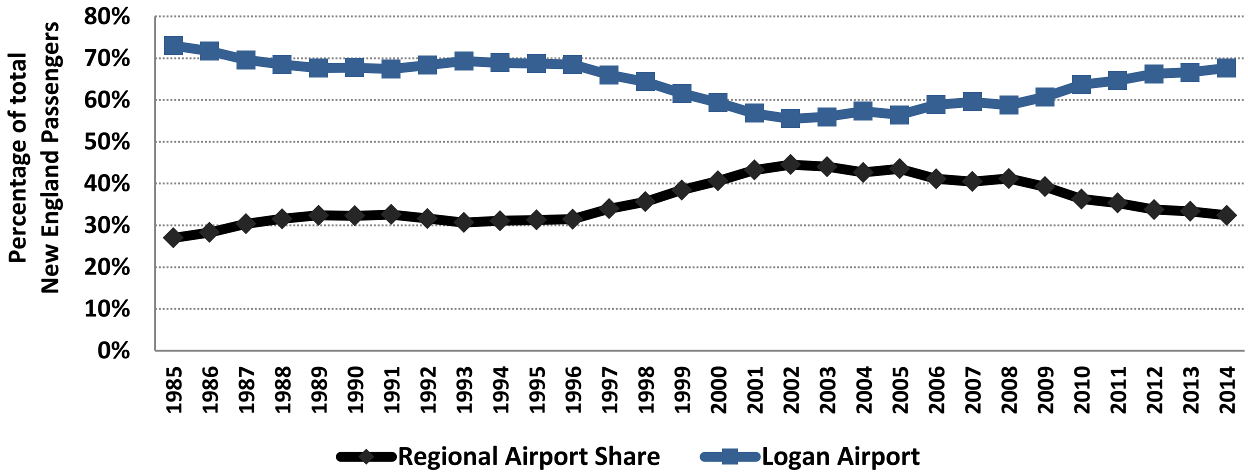
Table 4-1 Passenger Activity at New England Regional Airports and Logan Airport, 2010-2014

	Passenger Levels (millions)[1]					Percent Change
Airport	**2010**	**2011**	**2012**	**2013**	**2014**	**(2013-2014)**
Bradley International	5.34	5.61	5.38	5.42	5.88	8.4%
T.F. Green	3.94	3.88	3.65	3.80	3.57	(6.2%)
Manchester-Boston Regional	2.81	2.71	2.45	2.42	2.10	(13.5%)
Portland International Jetport	1.71	1.68	1.62	1.68	1.67	(0.5%)
Burlington	1.30	1.30	1.23	1.23	1.22	(1.0%)
Bangor	0.39	0.43	0.46	0.49	0.49	1.8%
Worcester Regional	0.07	0.11	0.03	0.02	0.12	670.6%
Tweed-New Haven	0.07	0.08	0.08	0.07	0.07	(8.1%)
Hanscom Field	0.00	0.01	0.01	0.00	0.00	NA
Portsmouth International[2]	0.00	0.00	0.03	0.04	0.06	29.2%
Subtotal	**15.63**	**15.81**	**14.93**	**15.17**	**15.16**	**(0.1%)**
Logan Airport	27.43	28.91	29.24	30.22	31.63	4.7%
Total	**43.06**	**44.72**	**44.14**	**45.36**	**46.79**	**3.1%**

Source: Massport and individual airport data reports.
Note: Data for Logan Airport includes international and connecting passengers.
1 All passengers in millions. Passenger levels are enplaned plus deplaned passengers (where available) or enplaned passengers times two.
2 Portsmouth International passengers revised for 2012 and 2013 to reflect existing records. Portsmouth International includes charter flight passengers starting in 2012

10 Based on U.S. DOT, Bureau of Transportation Statistics for scheduled passenger traffic.

Figure 4-3 Regional Airports' Share of New England Passengers, 1985-2014



Source: Massport and individual airport data reports.

Among the regional airports, Bradley International Airport and Worcester Regional Airport experienced some passenger traffic growth in 2014, while passenger levels at the majority of other regional airports remained flat or continued to decline slightly. An increase in airline service at Bradley International Airport resulted in passenger traffic growth, with passenger's activity levels growing by 453,826 or 8.4 percent in 2014. Worcester Regional Airport also saw passenger traffic growth of 101,565 following the introduction of commercial service by JetBlue Airways in November 2013. Manchester-Boston Regional and T.F. Green Airports experienced the largest declines, with passengers decreasing by 13.5 percent (326,428) and 6.2 percent (236,817) respectively in 2014. Portland International Jetport and Burlington International Airport passengers also decreased slightly in 2014, while Bangor International Airport and Portsmouth International Airport passenger traffic increased slightly.

Aircraft Operation Trends

This section reports on recent aircraft operations trends for the regional airports, including passenger aircraft operations, GA operations, all-cargo aircraft operations, and aircraft load factors.

Regional Airports Aircraft Operations

As shown in Table 4-2, total aircraft operations in the New England region (including Logan Airport) decreased by 4.3 percent in 2014, from 1.0 million operations in 2013 to 972,723 operations in 2014. The overall decrease in aircraft operations was primarily driven by declines in aircraft operations at the 10 regional airports in 2014. In 2014, total aircraft operations at the 10 regional airports declined by 7.0 percent (46,100 operations), whereas aircraft operations at Logan Airport increased slightly by 0.7 percent (2,500 operations) compared to the previous year.

Commercial operations in the New England region increased slightly from approximately 582,210 operations in 2013 to 584,530 operations in 2014. This represented a year-over-year change of 0.4 percent in 2014. Commercial operations at Logan Airport increased by 0.8 percent in 2014, helping to offset a decline of 0.2 percent at the other regional airports. This reflects a continuation in the trend of airlines monitoring and controlling capacity carefully following the more severe airline service cuts associated with fuel price increases

in 2008 and the economic recession of 2008/2009. The same trend was seen across the nation. Aircraft operations have increased at a slower pace than passenger demand, with airlines moving towards larger aircraft sizes and operating with higher passenger loads. Total U.S. commercial aircraft operations declined by 2.0 percent, while U.S. passengers increased by 3.1 percent in 2014.[11]

Combined GA operations at the regional airports and Logan Airport totaled 355,340 operations in 2014, a decline of 11.7 percent from 2013. GA operations at Logan Airport declined by 1.0 percent in 2014, while GA operations at the other regional airports declined by 12.4 percent. A decline in GA operations at Hanscom Field contributed significantly to the overall decrease in the region's GA operations. GA operations at Hanscom Field declined by 14 percent in 2014, due mostly to a drop in single engine piston local operations. Military operations at the regional airports increased slightly by 3.0 percent in 2014 following years of continued decline.

GA operations continue to be the dominant type of aircraft activity at the regional airports. In 2014, GA accounted for 54.0 percent of total aircraft operations at the regional airports. In comparison, GA represented only 7.3 percent of aircraft activity at Logan Airport, which primarily accommodates the region's domestic and international commercial airline operations. Commercial airline operations accounted for 40.6 percent of total operations at the regional airports in 2014. In comparison, commercial operations accounted for 92.7 percent of total operations at Logan Airport in 2014.

Overall, the regional airports accommodated a much greater share of the region's aircraft operations than their share of air passengers due to high levels of GA traffic. In 2014, the regional airports accounted for 32.4 percent of the region's passenger traffic, but 62.6 percent of aircraft activity. On average, there were approximately 24.9 passengers per aircraft operation at the regional airports compared to 87.0 passengers per operation at Logan Airport in 2014, largely reflecting aircraft sizes.

Total aircraft operations in the region in 2014 are well below the region's level of aircraft operations in 2000. Total aircraft operations are down by almost 40 percent, falling from 1.6 million in 2000 to approximately 972,700 in 2014. There were similarly large reductions in all three categories of activity – commercial, GA, and military. A number of factors have contributed to the declines. A shift to larger capacity aircraft and higher passenger load factors and a concurrent reduction in airline services at smaller regional airports have contributed to the declining trend in commercial airline operations. Factors negatively affecting GA operations include high fuel prices, a declining private pilot base, economic recessions, and slow economic growth. Annual aircraft operations from 2000 to 2014 are provided in *Appendix F, Regional Transportation.*

11 Airports Council International, 2012 Worldwide Airport Traffic Report.

Table 4-2 Aircraft Operations by Classification for New England's Airports, 2013 and 2014

	2013				2014				Percent Change (2013-2014)			
Airport	Commercial[1]	General Aviation[2]	Military[2]	Total	Commercial[1]	General Aviation[2]	Military[2]	Total	Commercial[1]	General Aviation[2]	Military[2]	Total
Bradley International	78,213	15,192	2,558	**95,963**	78,968	14,709	2,660	**96,337**	1.0%	(3.2%)	4.0%	**0.4%**
T.F. Green	48,340	24,729	435	**73,504**	43,888	16,105	622	**60,615**	(9.2%)	(34.9%)	43.0%	**(17.5%)**
Manchester-Boston Regional	43,572	11,432	1,224	**56,228**	38,674	12,293	908	**51,875**	(11.2%)	7.5%	(25.8%)	**(7.7%)**
Portland International Jetport	31,076	20,021	471	**51,568**	29,538	16,535	560	**46,633**	(4.9%)	(17.4%)	18.9%	**(9.6%)**
Burlington	26,814	40,413	6,972	**74,199**	26,057	40,858	6,842	**73,757**	(2.8%)	1.1%	(1.9%)	**(0.6%)**
Bangor[3]	14,707	15,535	11,045	**41,287**	14,428	15,466	11,527	**41,421**	(1.9%)	(0.4%)	4.4%	**0.3%**
Tweed-New Haven	4,094	28,794	423	**33,311**	4,795	26,273	529	**31,597**	17.1%	(8.8%)	25.1%	**(5.1%)**
Worcester Regional	173	35,064	593	**35,830**	2,521	28,565	978	**32,064**	1357.2%	(18.5%)	64.9%	**(10.5%)**
Portsmouth International	560	28,951	7,573	**37,084**	8,278	24,440	7,621	**40,339**	1378.2%	(15.6%)	0.6%	**8.8%**
Hanscom Field	0	155,469	612	**156,081**		133,684	604	**134,288**	NA	(14.0%)	(1.3%)	**(14.0%)**
Subtotal	**247,549**	**375,600**	**31,906**	**655,055**	**247,147**	**328,928**	**32,851**	**608,926**	**(0.2%)**	**(12.4%)**	**3.0%**	**(7.0%)**
Logan Airport	334,657	26,682	NA	**361,339**	337,381	26,416	NA	**363,797**	0.8%	(1.0%)	NA	**0.7%**
Total	**582,206**	**402,282**	**31,906**	**1,016,394**	**584,528**	**355,344**	**32,851**	**972,723**	**0.4%**	**(11.7%)**	**3.0%**	**(4.3%)**

Source: Massport; FAA Tower Counts; FAA Terminal Area Forecast; individual airport data reports.
Notes: Commercial operations at Hanscom Field include Streamline operations only; other air taxi operations included with GA. FAA tower counts used for MHT, PWM, HVN
1 May include some Air Taxi operations by fractional jet operators. FAA Tower counts combine some fractional jet operations with small regional/commuter airline operations.
2 Includes itinerant and local operations at the regional airports. Military operations at Logan Airport are negligible and not included in Massport counts.
3 Commercial operations at Bangor International Airport include international aircraft making a technical stop.
NE New England

Airline Passenger Service in 2014

Airlines can adjust service at an airport or on a specific route in two ways: by increasing or decreasing the number of flights operated; and/or by changing the size of the aircraft flown on the route. Changes in flight frequency and changes in aircraft size both affect the number of seats available to passengers, also known as seat capacity. Airline services are therefore typically discussed in terms of seat capacity as well as the number of flight departures.[12] This section examines changes in airline departures and seat capacity at the regional airports in 2014 and provides an overview of new and discontinued routes.

Service Developments at the Regional Airports

In 2014, a total of 11 airlines provided scheduled passenger service from the 10 regional airports to 39 non-stop destinations.[13] A few of the regional airports including Bradley International, Worcester Regional, and Portsmouth International Airports saw an increase in scheduled commercial services in 2014, but the majority of other airports experienced service declines. The steep airline service cuts seen after 2007 due to the 2008/2009 economic recession and high fuel prices have largely come to an end. However, airlines continue to be conservative in growing capacity, focusing on profitability and continuing to reduce frequencies on less profitable routes.

Table 4-3 shows the share of scheduled domestic departures for Logan Airport and the ten regional airports for the August peak travel month from 2010 to 2014. The regional airports' share of scheduled domestic departures in the New England region declined slightly from 39.1 percent in 2013 to 38.9 percent in 2014. The combined share for the medium-size airports – Bradley International Airport, T.F. Green Airport, and Manchester-Boston Regional Airport – fell from 26.3 percent in 2013 to 25.8 percent in 2014, while the smaller airports increased their share slightly from 12.8 percent to 13.1 percent. Details of scheduled passenger operations by market and carrier for the regional airports for the years 2000 to 2014 are presented in *Appendix F, Regional Transportation*.

Table 4-3 Share of Scheduled Domestic Departures – Logan Airport and the Ten Regional Airports, 2010-2014 (for August peak travel month)

	2010	2011	2012	2013	2014
Logan Airport	57.8%	57.5%	59.6%	60.9%	61.1%
Bradley International Airport; Manchester-Boston Regional Airport; T.F. Green Airport	29.5%	29.2%	27.6%	26.3%	25.8%
Bangor International Airport; Burlington International Airport; Hanscom Field; Portland International Jetport; Portsmouth International Airport; Tweed-New Haven Airport; Worcester Regional Airport	12.7%	13.3%	12.8%	12.8%	13.1%

Source: Official Airline Guide Market Files.

12 A departure is an aircraft take off at an airport. While aircraft operations include both departures and arrivals, airline services are typically described in terms of departures, as the number of scheduled departures generally equals the number of scheduled arrivals. Changes in departures translate to changes in overall operations.

13 Includes Allegiant Air, which serves Bangor International Airport (Punta Gorda, Sanford and St. Petersburg/Clearwater service), Burlington International Airport (Sanford service), and Portsmouth International Airport (Punta Gorda and Sanford service).

Bradley International Airport

Annual seat capacity at Bradley International Airport in Windsor Locks, CT increased by 6.4 percent in 2014. Expanded services by Southwest Airlines/AirTran Airways, JetBlue Airways, American Airlines, American Eagle, and Delta Air Lines resulted in some increase in scheduled departures and seat capacity. In 2014, Southwest Airlines (now fully merged with AirTran Airways) continued to operate new Atlanta service introduced by AirTran Airways in late 2013. JetBlue Airways had added new service to Fort Myers and Tampa in late 2013, and also introduced new service to Washington National Airport in 2014. American Airlines and American Eagle increased capacity on some routes, but also discontinued service to Los Angeles in 2014. United Airlines added new service to Houston Intercontinental Airport, but cut scheduled capacity overall, including on the Cleveland and Newark routes. Delta Air Lines increased capacity to Atlanta and also added new regional jet service to Cleveland.

T.F Green Airport

T.F. Green Airport (RI) saw continued reductions in scheduled departures and available seat capacity by the majority of airlines. The most significant cutbacks were implemented by Southwest Airlines, which discontinued service completely to Denver and cut frequencies on its Baltimore/Washington route in 2014. Other notable service cuts include the discontinuation of United Express service to Cleveland and the reduction of scheduled capacity by US Airways to Charlotte. Overall, scheduled seat capacity at T.F. Green Airport decreased by 7.0 percent in 2014. The Rhode Island Airport Corporation continues to seek new service offerings including international destinations.

Manchester-Boston Regional Airport

Manchester-Boston Regional Airport (NH) also experienced significant cutbacks by Southwest Airlines, United Airlines, and other carriers in 2014. Southwest Airlines had discontinued non-stop service to Philadelphia and Denver in 2013 and further reduced scheduled capacity on its Baltimore/Washington and Orlando routes in 2014. United Airlines exited the Cleveland market and further reduced frequencies to Newark in 2014. US Airways and Delta Connection also implemented service reductions. Scheduled seat capacity at Manchester decreased overall by 11.3 percent in 2014.

Portland International Jetport

Portland International Jetport (ME) experienced a 4.2 percent decline in airline seat capacity in 2014. Delta Airlines reduced frequencies on its Atlanta route and down-gauged from large jet to RJ service on its New York La Guardia route. United Express discontinued service to Cleveland and also reduced frequencies in the Newark market. Southwest Airlines was the one carrier that expanded services at Portland International Jetport, introducing new limited seasonal service to Orlando and Chicago Midway in 2014.

Burlington International Airport

Burlington International Airport (VT) gained new service by Allegiant Air, but also experienced overall declines in airline capacity in 2014. In 2014, JetBlue Airways continued to reduce scheduled seat capacity in the New York JFK market. United Express discontinued service to Cleveland, and US Airways also reduced scheduled frequencies in the Washington National Airport market. Low-cost leisure airline Allegiant Air launched operations at Burlington International Airport in 2014, introducing new large jet service to Orlando/Sanford. Overall, scheduled seat capacity at Burlington International Airport decreased by 2.5 percent in 2014.

Bangor International Airport

Bangor International Airport (ME) experienced some service additions in 2014, but these gains were offset by service reductions implemented by other carriers. In 2014, United Express introduced new service to Chicago O'Hare, and Allegiant Air added service to its third destination, Punta Gorda, from Bangor International Airport. However, Delta Connection reduced capacity in the La Guardia market and US Airways Express reduced

frequencies on its Washington National and Philadelphia routes. Overall, scheduled seat capacity at Bangor International Airport decreased slightly by 0.9 percent in 2014

Worcester Regional Airport

Worcester Regional Airport (MA) regained scheduled commercial service with the introduction of JetBlue Airways service to Fort Lauderdale and Orlando in 2013. Prior to the entry of JetBlue Airways, Worcester Regional Airport was served only by Direct Air, which operated regularly scheduled charter services from 2008 to 2012. When Direct Air filed for Chapter 7 bankruptcy in April 2012, Worcester Regional Airport lost all commercial service. A concerted marketing effort on the part of Massport and the local Worcester community resulted in the launch of JetBlue Airways at the Airport in November 2013. JetBlue operated year-round daily regional jet service to both Fort Lauderdale and Orlando in 2014, accounting for a five-fold increase in overall seat capacity compared to the prior year. Over 200,000 passengers have used Worcester Regional Airport since JetBlue Airways' start.

Tweed-New Haven Airport, Portsmouth International Airport, and Hanscom Field

Among the other smaller regional airports, Tweed-New Haven Airport (CT) experienced a decline in capacity as US Airways, the only carrier offering scheduled service, reduced seat capacity by 3.1 percent in 2014. Portsmouth International Airport, which had lost scheduled commercial service in 2008 when Allegiant Air left the market, regained commercial service in 2013 when Allegiant Air re-entered the market providing non-stop service to Orlando-Sanford. In 2014, Allegiant Air added service to a second destination, Punta Gorda, from Portsmouth International Airport, resulting in a significant increase in airline seat capacity compared to the prior year. Hanscom Field currently has no scheduled commercial service; public charter carrier, Streamline Air, introduced regularly scheduled service on turboprop aircraft from Hanscom Field to Trenton, NJ in 2011, but this service was later discontinued in 2012.

Regional Reliance on Logan Airport

Despite the service reductions at the regional airports in 2014, the trend of decreased reliance on connecting service through Logan Airport continued. Figure 4-4 shows that the share of flights between the regional airports and Logan Airport has been declining steadily since the mid-1990s. In the early 1990s, scheduled service to Logan Airport represented over 20 percent of regional airport flights. This share dropped as regional airports gained more non-stop service to both origin and destination (O&D) airports and airline connecting hubs. In 2010, the last scheduled flights from the regional airports to Logan Airport were eliminated entirely. The significance of this trend is that it reduces pressure on Logan Airport to provide connecting service for small planes from small communities to other destinations; this results in more convenient air service routings for passengers and opens up capacity at Logan Airport for transcontinental and international flights.

However, while service between the 10 regional airports and Logan Airport has been eliminated, other remote communities in New England continue to rely on Logan Airport for connecting services. Logan Airport acts as a connecting hub for a number of other New England airports, such as the Cape Cod and Island Airports. Logan Airport remains the sole commercial air service destination for some communities, such as Augusta, Presque Isle, and Rockland, ME, as well as Rutland, VT.

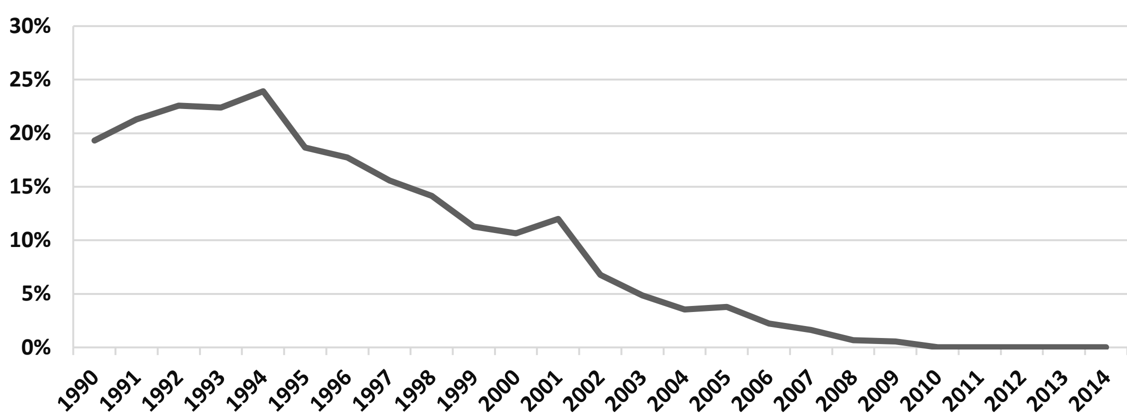
Regional Aviation Economic Impact Study

In 2014, the Aeronautics Division of MassDOT completed a wide-ranging economic impact study of the statewide airports system's (the 39 public use airports including Logan Airport) contribution to the economy of Massachusetts. The analysis found that Massachusetts public use airports generated $16.6 billion in total economic activity, including $6.1 billion in total annual payroll resulting from 162,250 jobs that can be traced to

the aviation industry.[14] In particular, Massport's three airports are noted to make significant contributions to the regional economy generating approximately $15.1 billion or 91 percent of the overall economic benefits generated by the Massachusetts airport system.[15] Specifically, Logan Airport supported approximately 132,000 jobs in Massachusetts and the total economic impact is now estimated at approximately $13.4 billion per year.[16] Hanscom Field supported 12,355 jobs and a total impact of $1.6 billion while Worcester Regional Airport supported 360 jobs and a total economic impact of $46.4 million. Hanscom Field is particularly important for its function as an active military facility, which is aided by its proximity to Boston-area technology and research industry. For every $100 spent by aviation-related businesses, an additional multiplier impact of $56 is created within Massachusetts according to the study. While the economic impact of the region's airports was the focus of the study, it also noted qualitative benefits of the state's airports including:

- Facilitating emergency medical transport;
- Providing police support;
- Supporting aerial surveying, photography, and inspection operations;
- Conducting search-and-rescue operations;
- Supporting the U.S. military and other government operations; and
- Providing youth outreach activities.

Figure 4-4 Share of Flights Originating at Regional Airports with Logan Airport as Destination, 1990-2014



Source: Official Airline Guide Market Files (August for each year).
Note: Includes all New England airports with scheduled airline service.

14 Massachusetts Department of Transportation Aeronautics Division. *Massachusetts Statewide Airport Economic Impact Study Update Executive Summary*. (2014). http://www.massdot.state.ma.us/portals/7/docs/airportEconomicImpactSummary.pdf Accessed July 26, 2015.
15 Ibid.
16 Ibid.

Regional Airport Facility Improvement Plans

The following section describes significant airport improvements that are planned or under construction at the regional airports in the near future.

T.F. Green Airport

In September 2011, the FAA issued a favorable Record of Decision (ROD) approving the Preferred Alternative for the T.F. Green Airport Improvement Program, which will allow an extension to the airport's main runway to allow for non-stop flights to the West Coast as well as Runway Safety Area improvements on the crosswind runway, and other projects. In January 2013, the FAA issued a final Written Reevaluation of the ROD, as project design and construction phasing had changed since the ROD was issued. Construction of project elements of the T.F. Green Airport Improvement Program began in July 2013 and are expected to continue through 2017. The Airport Improvement Program includes the following projects:

- The Runway 16 End Safety Area improvements involved installation of Engineered Material Arresting System (EMAS), airfield electrical improvements on the Runway 16 end, and reconfiguration of the taxi lane from the northeast ramp to the Runway 16 end. This project is complete.
- The demolition of Hangar 1 was completed in July 2014.
- Construction for the Runway 34 End Safety Area improvements began in 2014. Major elements of the project include the reconstruction of 1,650 feet of Runway 16-34, EMAS construction at the Runway 34 end, partial reconstruction of Taxiway C, and construction of the associated airport service road. Construction is expected to be completed by the end of 2015.
- The Runway 5 extension is expected to begin in 2016 and be completed by the end of 2017. This project involves extension of the primary runway from its current length of 7,166 feet to 8,700 feet, which will allow for long haul flights to West Coast destinations. The project also involves an extension of the parallel Taxiway M and construction of an EMAS at the Runway 5 end. The Main Avenue relocation (an enabling project for the runway extension) is scheduled to begin June 2015 and will take one year to complete.
- The Runway 5 extension required the relocation of Winslow Park, which commenced in June 2014 and was completed in the summer of 2015. Work included replacement of the existing soccer and softball fields, playground facility, concession and restroom facilities as well as roadway calming treatments and landscaping improvements.

Separate from the T.F. Green Airport Improvement Program, construction of a Deicer Management System, which will collect and treat the glycol used to de-ice aircraft at T.F. Green Airport, began in 2013. Field construction was completed in April 2015. The system is expected to be operational by the end of 2015.

Manchester-Boston Regional Airport

Since the early 1990s, over $500 million was invested in Manchester-Boston Regional Airport to improve and develop landside and airside facilities and infrastructure. Projects included a 158,000-square foot passenger terminal and two subsequent 75,000-square foot terminal additions, a 4,800-space parking garage with an elevated pedestrian walkway connection to the terminal, roadway improvements, runway safety area improvements, and extensive runway reconstruction and lengthening. Recent customer service enhancement initiatives have included the construction of a new cell phone lot in 2007 for motorists waiting to pick up passengers and various concessions improvements through 2008 and 2009.

Manchester-Boston Regional Airport completed an Airport Master Plan Update in 2011. The master plan update provides a blueprint for development and improvement of airport facilities and infrastructure through 2030. Recent and on-going improvement projects at the airport include:

- The Terminal Ramp Replacement Project to rehabilitate the concrete apron areas adjacent to the terminal building began in 2012 and was completed in 2013.
- Demolition of structures in the runway protection zone (RPZ) of Runway 6 will remove buildings with usages deemed non-compatible with RPZs as defined by the FAA. Elements of the project include demolishing the Highlander Inn and Conference Center and associated buildings.
- Upgrades to the terminal building heating, ventilation, and air conditioning (HVAC) systems will address certain deficiencies in the terminal cooling system and will provide significant improvements to customer comfort levels within areas of the terminal building.
- Parking Lot A Access improvements.
- Overlaying a portion of Taxiway M.

Other potential projects over the coming years include: roadway and parking improvements; curbside enhancements; refurbishing and expansion of baggage claim equipment; construction of a glycol collection/treatment facility; and construction of a snow removal equipment storage building.

Bradley International Airport

A $200 million airport modernization project at Bradley International Airport was completed in 2010. Originally launched in 2000, the modernization project introduced a refurbished and expanded Terminal A with an additional 260,000 square feet of new concourse, ticket counters and waiting areas, major gate renovations, and a state-of-the-art security and communications system. A 28,000-square foot International Arrivals Building was also completed.

In 2011, the Connecticut Airport Authority (CAA) was established to oversee the operation and development of Bradley International Airport. The CAA, a quasi-public agency consisting of an 11-member board, manages day-to-day operations at Bradley International Airport, as well as at five GA airports in Connecticut. The goal of the CAA is to transform Bradley International Airport and the state's five GA airports (Danielson, Groton/New London, Hartford Brainard, Waterbury-Oxford, and Windham airports) into economic drivers for the state. Bradley International Airport was previously run by a board under the Connecticut Department of Transportation.

A three-year renovation project for the airport hotel, the Sheraton Bradley Airport Hotel, was completed in 2011, featuring newly outfitted guest rooms, a redesigned lobby, and an expanded fitness center and pool. More recently the CAA has announced the completion of a food court renovation as well as the opening of a new cell phone waiting lot. The 2010 to 2013 *Bradley International Airport Strategic Plan* highlights several airport improvement projects between 2012 and 2013. These projects include:

- A sound insulation program;
- Rehabilitating Taxiway C North;
- Rehabilitating Taxiway C South;
- Utility relocation and obstruction removal;
- Demolishing old Murphy Terminals and designing of new Terminal B; and
- Constructing roadway realignment.

The airport's $280 million capital improvement program for FY 2014 through FY 2018 includes the following projects:

- A consolidated rental car facility;
- Demolishing the Murphy Terminal;
- Roadway demolition and re-alignment;
- Utility relocation; and
- Airfield improvements.

Hanscom Field

Massport continues to invest in Hanscom Field to improve and upgrade facilities and maintain a safe, secure, and efficient airport. Past and future capital investments ensure that Hanscom Field can continue to serve its role as a GA reliever to Logan Airport and premiere business aviation facility for the region. In FY 2012 and 2013, Massport invested over $5 million in airfield, terminal, equipment, and other facility improvements at Hanscom Field. Massport invested another $2.2 million in facility improvements in FY 2014. These airport improvement projects are summarized in the annual reports on *The State of Hanscom*.[17]

Massport's recent capital investment projects at Hanscom Field included:

- Maintenance of vegetation removal areas and the trail system that connects two Massport-owned parcels with portions of conservation land and open spaces in the towns of Bedford and Concord.
- Development of the *2014 to 2018 Vegetation Management Plan Update*. The Vegetation Management Plan Update and Notice of Intent for vegetation removal was submitted to four towns' conservation commissions. All four conservation commissions issued Orders of Conditions.
- Massport installed a wildlife exclusion fence near the Shawsheen River.
- Replacement of the electrical infrastructure to Hangar 3.
- Pavement rehabilitation surrounding the Pine Hill T-hangars was completed.

Planned projects for FY 2015 and beyond include:

- The field maintenance garage roof will be replaced.
- Airfield pavement replacement will continue to be an ongoing project in coming years.
- Runway 5 safety area beyond the runway end will be rehabilitated.
- Portions of the perimeter security fence will be replaced.
- Signage and landscaping will be implemented at the entrance of Hanscom Drive.
- The electrical feeders for Hangars 1 and 2 will be replaced.

In addition to Massport's investments, the Authority solicits third-party development of facilities that support and enhance Hanscom Field's role in the regional transportation system. Many of the hangars at Hanscom Field are owned or leased by tenants who are responsible for maintaining them.

On-going third-party projects at Hanscom Field include:

17 Massport. *The State of Hanscom.* https://www.massport.com/media/310211/StateOfHanscom-2014.pdf. Accessed July 26, 2015.

- In 2012, Rectrix was selected by Massport to develop fixed-base operator (FBO) facilities at the former Hangar 24 site. Demolition of the hangar was completed in September 2012. In 2013, Rectrix obtained required permits and began construction of the new hangar and FBO facility. Rectrix completed construction and opened the facility in 2014.
- The Massport Board approved a proposal by Jet Aviation, a current FBO operator at Hanscom Field, to replace Hangar 17 with a more modern facility. In 2012 and 2013, Jet Aviation undertook the planning and design process. In 2013, Jet Aviation submitted an Environmental Assessment to the FAA to begin the permitting process. In 2014 the permitting process continued and The Massachusetts Department of Environmental Protection approved the project in March 2015. Construction began in July 2015.
- Massport is in the process of working with General Services Administration (GSA) to acquire a parcel of land north of the airfield currently owned by the U.S. Navy. The transfer is expected to be complete by early 2016. Initial planning for aviation uses of this parcel is underway.

Worcester Regional Airport

The Worcester Regional Airport Master Plan Update, completed in 2008, was funded by the FAA and the former Massachusetts Aeronautics Commission. The Worcester Master Plan provides a strategic roadmap to guide airport development through 2020. Near-term projects were focused on maintaining essential operations, safety, and security functions and included runway pavement reconstruction, runway safety area upgrades, and a vegetation removal and maintenance plan. Long-term initiatives include upgraded corporate/GA facilities including a FBO facility and hangars, a new Airport Rescue and Firefighting Facility (ARFF), and ongoing runway and taxiway pavement rehabilitation. Various demand-driven projects including terminal enhancements and additional parking facilities were also identified; however, these projects depend on the level and type of future aviation activity realized at Worcester Regional Airport.

JetBlue Airways at Worcester Regional Airport
Source: Massport.

Massport is currently pursuing enhancements to Worcester Regional Airport's all-weather capability including upgrading the Runway 11 Instrument Landing Systems (ILS) from a CAT I to a CAT III system, and its associated required infrastructure and navigation aids along with a partial parallel taxiway. This project, which would allow aircraft to land on Runway 11 during virtually all weather conditions, is a safety and operational priority for the Airport. Massport submitted an Environmental Notification Form (ENF) for the *Worcester Regional Airport CAT-III Instrument Landing System and Taxiway Project* to the Massachusetts Executive Office of Energy and Environmental Affairs in January 2014. The MEPA Office determined that no further review is required. The FAA issued a Finding of No Significant Impact (FONSI) in February 2015; construction is underway.

Massport started a $3 million renovation project in April 2014 that includes the demolition of the control tower, safety upgrades, and a Category III ILS.

In January 2012, Massport approved a proposal by Rectrix to develop an aircraft hangar and office space at Worcester Regional Airport. The FAA issued a Finding of No Significant Impact (FONSI) on August 13, 2013.

Construction started on the $6.7 million project in August 2013. The Rectrix project includes 27,000 square feet of hangar and office space that will house large corporate jets and a regional aircraft maintenance facility. Rectrix will offer private jet charters and FBO services, including transient aircraft parking and fueling services from the new hangar facility. The FAA issued a FONSI on April 4, 2014. Construction is underway and expected to be complete in 2015.

In October 2014, Massport received a FONSI from FAA for a future maintenance hangar at Worcester Regional Airport. A developer for the proposed 40,000 – 50,000 square foot hanger has yet to be identified.

Massport and third party developers have committed to invest in the following additional airside and landside improvement projects over the next few years:

- Installation of a new terminal roof and HVAC system;
- Airside and landside pavement rehabilitation;
- Rehabilitation of the existing ARFF station (underway);
- Security improvements; and
- Obstruction removal.

Long-term Worcester Roadway Improvements
In 2008, the Central Massachusetts Regional Planning Commission (CMRPC) initiated the *Worcester Regional Mobility Study*[18] that was envisioned as a transportation plan with the goal of improving the movement of people and goods throughout the Greater Worcester Region. The final Study was released in May 2011. One of the Study's objectives was to improve ground transportation access between the regional roadways and Worcester Regional Airport within the context of an "economic development corridor" that could benefit other local businesses. Several alternative routes were identified and recommended for further study including a new interchange off Interstate 90 in the vicinity of Route 56. The Study also assessed a range of alternatives to address regional mobility concerns and recommended 13 roadway infrastructure improvements intended to reduce congestion, enhance regional mobility, and address existing interchange/intersection constraints. The study presented the recommended phasing and packaging of recommended alternatives into short-term (zero to five years), mid-term (five to 10 years), and long-term actions (over 10 years).

Near-term Worcester Directional Signage Improvement Program
CMRPC also supported Massport's goal to identify immediate actions for improving roadway access to Worcester Regional Airport through a signage improvement program. In collaboration with MassDOT and the City of Worcester, Massport identified six primary routes now used by travelers to access Worcester Regional Airport. The team also developed a sign design and placement plan. The goal was to improve directional signage on these roads between Worcester and the Massachusetts Turnpike and Interstate 290 by achieving the following objectives:

- To ensure that key decision points would be adequately signed;
- To reduce sign "clutter" by removing old and unnecessary signs; and
- To design and install new airport trailblazer signs consistent with Massport's and MassDOT's way finding standards.

18 Central Massachusetts Regional Planning Commission. *Worcester Regional Mobility Study.* http://www.cmrpc.org/sites/default/files/download/Worcester_Mobility_Study_RFP_02262008.pdf. Accessed July 26, 2015.

MassDOT has installed the desired signs that were produced by the Massport Sign Shop. To date, more than 80 signs have been installed including several signs on Auburn roads approved by the Town of Auburn in March 2011.

Regional Long-Range Transportation Planning

A balanced regional intermodal transportation network would reduce reliance on Logan Airport as the region's primary transportation hub and provide New England travelers with a greater range of viable transportation options. This section highlights efforts to achieve this balance through cooperative transportation planning at a broad array of transportation agencies and concerned parties to promote an integrated, multi-modal regional transportation network.

In 2009, MassDOT was created to unify the state's various transportation agencies. The unified MassDOT brought together many Commonwealth entities that plan, build, own, operate, and maintain all modes of transportation, under a five-member board of directors. In 2015 the MassDOT Board was expanded to an 11- member board of directors and a separate five-member MBTA Financial Oversight Board. (Massport remains an independent authority focused on airport and seaport needs with its own board of directors, including the Secretary of MassDOT). The creation of MassDOT was intended to help integrate, coordinate, and prioritize multimodal transportation policy and investment in Massachusetts, resulting in a more effective, efficient, equitable, rational, and innovative transportation system. As a fundamental part of the transportation framework in the Boston metropolitan area, and for all of New England, Massport supports an integrated multimodal transportation policy to improve the efficient use of transportation infrastructure on both a metropolitan and a regional scale. In 2011, MassDOT continued to make strides in improving the existing transportation infrastructure by addressing structurally deficient infrastructure with innovative construction techniques, developing a comprehensive environmental responsibility and sustainability initiative, and continuing to invest in the Boston metropolitan area's rapid transit.

Logan Airport's functional role is New England's premier commercial airport, providing an essential and efficient connection between the New England states and the global economy. Recent studies have indicated that there is a serious lack of usable aviation capacity in the coastal mega-regions[19] (although not in Boston itself) and identify a need for access to alternative forms of short-distance travel across these regions.[20] Since the construction of a second major Boston airport has been judged impractical in the past, the potential of high-speed rail is increasingly being viewed as an important complementary component in the regional transportation system and aviation planning.[21] Given the comparable travel times, proximity of service to downtown Boston, and the potential for highly efficient electrified propulsion, high-speed rail could provide efficient intercity connectivity for city-pairs in a corridor up to 600 miles long, which would be competitive with air travel.[22] Boston's South Station is undergoing planning and design for expansion that would support the current and future rail mobility in Massachusetts and along the Northeast Corridor (NEC) including supporting future high-speed rail. In 2012, Amtrak services in the NEC had a 54 percent share[23] of the Boston-New York City markets (excluding traffic by other surface modes such as private car and bus).

19 The coastal mega-regions are the continuously urbanized areas along the east and west coasts of the U.S. (Washington, DC, Philadelphia, New York City, Hartford, Boston)
20 FAA: *Capacity Needs in the National Airspace system 2007-2025* (commonly referred to as FACT-2) and TRB: *ACRP Report 31: Innovative Approaches to Addressing Aviation Capacity Issues in Coastal Mega-regions.*
21 Transportation Research Board *ACRP 03-23: Integrating Aviation and Passenger Rail Planning*.
22 "Where High-Speed Rail Works Best" America 2050 - http://www.america2050.org/pdf/Where-HSR-Works-Best.pdf Page 1-2
23 Latest available statistics from Amtrak; nothing more recent has been released.

Massachusetts Statewide Airport System Plan (MSASP)

The MassDOT Aeronautics Division completed the *Massachusetts Statewide Airport System Plan* (MSASP) in 2010. The MSASP provides guidance to state policy makers for the long term development of the Commonwealth's airport system. It documents the status of the current airport system; provides a long term vision for the system; identifies system goals and related improvements; establishes priorities for system and airport funding; and provides supporting data and materials.

Boston and Statewide Long-term Transportation Vision

The Boston MPO is currently developing a long-range vision for the region and its transportation network in 2040 titled *Charting Progress to 2040*.[24] The vision described by the Boston MPO identifies the Boston metropolitan region as continuing to be an economic, educational, and cultural hub which will continue to contribute to the high quality of life. The high quality of life will be supported by a well-maintained transportation system consisting of safe, healthy, efficient, and varied options. The variety of transportation options will allow people to find jobs and services within easy reach of affordable housing, and will reduce environmental impacts thereby improving air and environmental quality. This vision is possible through attentive maintenance, cost-effective management, and strategic investment in the region's transportation system. This vision is broad-based; more specifically for the Airport, the long-range vision finds that support for air cargo is critical as the State Freight Plan[25] finds air freight shipping to grow more quickly than any other shipping mode.

Although the other New England states have statewide long-term transportation plans, Massachusetts currently does not. MassDOT is currently undertaking the Commonwealth's first statewide strategic multi-modal transportation plan known as *weMove Massachusetts*.[26] The philosophy behind *weMove Massachusetts* is that MassDOT needs to make logical, defensible, and smart choices on how to invest the agency's limited resources based on the articulated values. The goals of *weMove Massachusetts* are to engage stakeholders through a bottom-up approach as well as internal agency stakeholders in a discussion about the present and future needs of the transportation system, to build action-oriented policies based on stakeholder feedback that can serve as a bridge between MassDOT's values and investments, and to develop a forward thinking, data-driven, decision-making methodology to assist MassDOT in implementing its priorities transparently and measurably.

Massport is an active participant in the development of the Boston MPO long-range transportation plan and has a representative on the *weMove Massachusetts* Stakeholder Advisory Group.

Regional Cooperative Planning Efforts

Several regional transportation cooperation planning efforts are underway, as described below.

New England Regional Airport System Plan (NERASP)
In fall of 2006, the FAA New England Region, in concert with the New England Airport Directors and New England State Aviation Directors, completed the NERASP. The results of this study describe the foundation of a regional strategy for the air carrier airport system to support the needs of air passengers through 2020. To date, the development of that strategy has been instrumental in facilitating the investment and development of the primary commercial airport system in New England.

24 Boston Region Metropolitan Planning Organization. *Charting Progress to 2040.*
25 Massachusetts Department of Transportation. *State Freight Plan*. September 2010.
26 https://www.massdot.state.ma.us/wemove/Home.aspx

During preparation of the 2006 NERASP study, which analyzed the primary commercial airports in New England, the group recognized that a similar evaluation of GA would also prove useful. It would provide state aviation officials with a greater understanding of airport roles and infrastructure investment. Faced with the current economy, rising airport and aircraft operational costs, declining operational activity, an aging infrastructure and with limited state and federal funds to address improvements, the importance of developing both a short-range and long-range perspective on the future performance of the New England GA airport system is clear.

New England Regional Airport System Plan – General Aviaton (NERASP-GA)
The New England state aviation officials, in partnership with the FAA, are currently conducting a study of the GA airport system in New England, including primary commercial service airports that service a GA component. This assessment of the New England GA airport system will provide state aviation officials with a common understanding of their state airport system in relation to the New England region as a whole. Assisted by this information, the FAA will be better positioned to make decisions regarding priority capital investments. Moreover, the NERASP study proved that the geographic boundary of the New England region, as well as its cultural identity, makes an overall study of New England an effective planning approach. Information on the NERASP-GA study can be found at http://www.nerasp-ga.com.

Conference of New England Governors and Eastern Canadian Premiers
The Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) is a formally established body that coordinates regional policy programs in the areas of economic development, transportation, environment, energy, and health, among others. The NEG/ECP focuses on aviation and intercity passenger rail, particularly in the northeastern coastal mega-region, as part of a larger transportation system that needs modal balance. Efficient use of this multi-state network affects the overall viability of the highway, aviation, freight, and commuter rail transportation networks that serve the region and the nation. Improved planning coordination between airports and intercity passenger rail services and related ground transportation offers the potential to achieve complementary investments in airport and rail capacity and services. MassDOT has a representative on the NEG/ECP Transportation and Air Quality Committee which covers regional transportation issues and infrastructure development, use, and efficiency. The NEG/ECP and other policy decision makers throughout the region have been able to utilize strategies and information developed in the NERASP, which provides a framework for integrated regional aviation policy and planning. This organization serves an important function to help achieve a greater balance between air, rail, and auto trips, and ultimately help to increase overall transportation capacity without overburdening Logan Airport and the New England aviation system.

In 2011, the NEG/ECP passed a resolution on transportation which provided direction on enhancing alternative-fuel vehicle infrastructure in the region, increasing multi-modal transportation options, and improving freight and passenger rail networks.[27]

Regional Rail Transportation Initiatives

This section reports on recent developments and current rail service originating in Boston, the status of air-rail linkages in the Northeast Corridor, and the expanding Pilgrim Partnership, which provides commuter rail between Massachusetts and Rhode Island.

27 Conference of New England Governors and Eastern Canadian Premiers. Resolution 35-4, "Resolution Concerning Transportation". July 11, 2011.

Amtrak Northeast Corridor
Amtrak's NEC is an intercity rail line that operates between Boston-South Station and Washington, DC via New York City. Other major destinations served by the route include Providence, RI; New Haven, CT; Philadelphia, PA; and Baltimore, MD. Logan Airport passengers can connect directly to Boston-South Station via Silver Line bus rapid transit (BRT) service or via taxi. Amtrak operates two services between Boston and Washington, DC: the Acela Express (high-speed, limited-stop service) and the Northeast Regional (lower-speed service that makes local stops along the route). Travel times on the Acela Express range from 3.5 hours from Boston to New York to just over 6.5 hours from Boston to Washington, DC. Travel times on the Northeast Regional range from about 4.25 hours from Boston to New York to approximately 7.75 hours from Boston to Washington, DC. A total of 19 daily departures are offered from Boston-South Station to Penn Station in New York, of which about half are Acela Express. Most trips continue south to Washington, DC, and a smaller number of Northeast Regional trains continue further south to Newport News, Virginia.

System-wide Amtrak ridership was 30.9 million one-way trips in Fiscal Year 2014, an increase of 0.2 percent over Fiscal Year 2013. The NEC represented about 36 percent of total system-wide Amtrak ridership. In Fiscal Year 2014, the NEC carried 11.6 million passengers for a total increase of 3.3 percent (0.2 million passengers) over the number of passengers in 2013 (11.4 million). In 2014, Acela Express accounted for 3.55 million passengers, while the Northeast Regional accounted for 8.08 million passengers. Overall NEC ridership reached a new record in 2014, matching and surpassing the previous 2008 peak of 10.9 million passengers and up significantly from 8.4 million in 2000. Amtrak’s share of the Northeast total passenger market has increased substantially since the introduction of Acela Express service in 2000.

Recent forecasts of Amtrak ridership along the NEC indicate that ridership could reach 17.4 million passengers in 2020, 26.2 million passengers in 2030, and expand to 43.5 million passengers in 2040. This forecast indicates that the substantially reduced travel times of high-speed rail transportation would become more attractive along the NEC.[28]

Northeast Corridor Infrastructure Master Plan and Next-Generation High Speed Rail Plan
The *Northeast Corridor Infrastructure Master Plan*, a new regional rail planning study, was released in May 2010. The Master Plan documents NEC growth needs through 2030, including expanded capacity and improvements in Boston-New York and New York-Washington intercity travel times. A 76 percent increase in rail ridership from 13 million to 23 million[29], a 36 percent increase in train movements from 154 average weekday to 210 average weekday, and the need for $52 billion in additional capital investment is expected over the next 20 years. Amtrak is currently preparing a future plan for the Northeast Corridor. This is being evaluated in a Tier 1 Draft Impact Statement which is expected to be completed at the end of 2015.

To follow up on the release of the Northeast Corridor Infrastructure Master Plan, Amtrak also unveiled a Next-Generation High-Speed Rail proposal in September 2010 titled *A Vision for High-Speed Rail in the Northeast Corridor*. The proposal outlines a brand-new 426-mile two-track corridor running from Boston to Washington, offering high-speed rail service with sustained maximum speeds of 220 mph. The route would allow for an 84-minute trip time between Boston and New York and a three-hour trip time between Boston and Washington. Under this Next-Generation high speed rail plan, the New York City – Boston market would see a further shift from auto and air to rail due to the dramatic improvements in rail travel times, and it projects that the air market between the two city-pairs to be nearly eliminated by 2050.[30] This plan states that traveler’s shift to high speed rail would reduce delays on competing modes (air and auto) and the shift away from

28 “The Amtrak Vision for the Northeast Corridor: 2012 Update Report.” Amtrak. July 2012.
29 Includes ridership on Amtrak and state rail lines, but excludes ridership on commuter rail lines.
30 “A Vision for High-Speed Rail in the Northeast Corridor” Amtrak September 2010, Page 21.

shorter and smaller intraregional flights would free up air transport capacity for higher-value transnational and international flights.[31]

An update to the *Northeast Corridor Infrastructure Master Plan* and *A Vision for High-Speed Rail in the Northeast Corridor* was released in July 2012. Since these two documents were released, the two programs have been integrated into a single coherent service and investment program, called the Northeast Corridor Capital Investment Program. The Northeast Corridor Capital Investment Program would advance the near-term projects outlined in the Master Plan to benefit the NEC while incrementally phasing improvements to the Acela Express high-speed service to support the next-generation high-speed rail proposed.[32] The near-term NEC improvements are identified to occur between 2012 and 2025 and the long-term Next-Generation High-Speed Rail improvements are identified to occur between 2025 and 2040. The publication of the 2012 update is the first step in "improving the NEC for all users in order to sustainably support the population and economic growth facing the Northeast over the next 30 years" but a considerable amount of additional planning work is required by all stakeholders.[33]

In 2011, the U.S. DOT awarded Amtrak and the New York State DOT $745 million for two high-speed rail projects on the NEC. A major upgrade to tracks and overhead wires will be conducted along a 24-mile stretch in New Jersey, allowing for an improvement in Acela Express train speeds from 135 mph today to 160 mph. Improvements to the Harold railroad interlocking in Queens, NY will also be completed, eliminating delays and reducing commuting time for Amtrak riders.

Boston-South Station Expansion
In support of the Northeast Corridor Capital Investment Program, MassDOT is currently designing and planning to expand of Boston-South Station to meet the infrastructure and capacity needs of the NEC. At present, South Station operates above its design capacity for efficient train operations and orderly passenger queuing. Operating with only 13 tracks, South Station constrains the current and future rail mobility within Massachusetts and through New England and the NEC.[34] The proposed expansion of South Station will result in the following benefits to rail mobility:[35]

- Improve the performance of existing and future high-speed and intercity passenger rail service to and from Boston. Today's NEC on-time performance is approximately 85 percent for Acela Express and 75 percent for Northeast Regional trains. The 2030 target for on-time performance is 95 percent for Acela Express and 90 percent for Northeast Regional. Without expanding South Station and its support facilities, not only will these targets be missed, but on-time performance will deteriorate even further.
- Enable growth in high-speed and other intercity passenger rail service in the northeastern U.S., at a time when both the roadway and aviation networks are at or over capacity.
- Support sustainable economic growth and improved quality of life in NEC metropolitan areas, including Boston.
- Support a more attractive and increased Massachusetts Bay Transportation Authority (MBTA) Commuter Rail service, with associated benefits such as increased statewide transportation access, environmental sustainability, and improved personal mobility.

31 "A Vision for High-Speed Rail in the Northeast Corridor" Amtrak September 2010, Page 21.
32 "The Amtrak Vision for the Northeast Corridor: 2012 Update Report." Amtrak. July 2012.
33 Ibid. pg. v.
34 "Boston South Station High Speed Intercity Passenger Rail Expansion Project." Massachusetts Department of Transportation. August 6, 2010.
35 Massachusetts Department of Transportation. "South Station Expansion Project Website." http://www.massdot.state.ma.us/southstationexpansion/Home.aspx. Accessed August 2, 2012.

For the South Station track expansion to be implemented as currently conceived by MassDOT, the existing U.S. Postal Service (USPS) General Mail Distribution Facility located adjacent to South Station must be relocated. The USPS has undergone a national study of its facilities for streamlining and consolidation. While that process is still continuing, it is currently assumed that the USPS facility will remain in its current location and thus needs to be relocated for track expansion to occur. Massport has worked cooperatively with MassDOT, the MBTA and the USPS to identify a site on Massport property in South Boston that could be the recipient site of a relocated USPS facility should that become necessary. The project is currently undergoing MEPA review.

Commuter Rail Services
The Pilgrim Partnership is an arrangement between the MBTA and the Rhode Island Department of Transportation (RIDOT), under which RIDOT allocates some of its federal funding to the MBTA in return for commuter rail service to Boston from Rhode Island. Sixteen daily round-trips are provided between Boston and Providence. Expanded commuter rail service to T.F. Green Airport in Warwick, RI was introduced in December 2010. Travel time between Boston and Warwick is approximately 1.25 hours, and 10 of the 16 daily Boston-Providence departures currently continue on to Warwick. Expanded service to Wickford, RI commenced in 2012, with an eventual extension to Kingston, RI also planned. RIDOT has initiated design and environmental permitting for Barnum Station in Kingston, RI.

The extended commuter rail enhances ground access options from the Boston metropolitan area to T.F. Green Airport. The passenger catchment areas of T.F. Green Airport and Logan Airport overlap, and this new commuter rail service has the potential to attract passengers in the overlapping catchment area living along the Providence/Stoughton MBTA commuter rail line to T.F. Green Airport.

Other Regional Cooperative Planning Efforts

Recognizing that Logan Airport is a substantial trip generator and key transportation resource in the metropolitan area, Massport participates in several interagency transportation planning forums pertaining to enhancing a variety of travel modes.

GreenDOT
GreenDOT is a comprehensive sustainability initiative with three primary goals: reduce greenhouse gas (GHG) emissions; promote the healthy transportation options of walking, bicycling, and public transit; and support smart growth development. GreenDOT is MassDOT's policy mechanism to achieve the GHG reduction targets set out in the Executive Office of Energy and Environmental Affairs (EEA) GHG reduction plan enabled by the Global Warming Solutions Act of 2008. Massport is fulfilling the intention of GreenDOT by working to reduce GHG emissions associated with surface transportation to the Airport, and by providing more accommodations for walking, bicycling, and public transit. MassDOT's mode shift goal is to triple the current mode share of bicycling, public transit, and walking, each by 2030. Massport supports GreenDOT's smart growth development goal by actively working to improve public transportation in the metropolitan area, a key component of smart growth principles (information on GreenDOT provided at www.massdot.state.ma.us/GreenDOT.aspx).

Massport has participated in an interagency Transportation Sustainability Committee organized by MassDOT, leading up to the development of MassDOT's GreenDOT Implementation Plan. The final GreenDOT Implementation Plan was completed in December 2012 and developed to serve as the framework for embedding the sustainability goals of GreenDOT into the core business and culture of MassDOT. The Implementation Plan captures current MassDOT innovations, leading sustainability policies of the Commonwealth, and national best practices and presents a guide to achieve the sustainability and livability vision of MassDOT.[36] The Implementation Plan identifies fifteen sustainability goals organized under seven sustainability themes: Air; Energy; Land; Materials; Planning, Policy & Design; Waste; and Water. These goals work towards decreasing resource use, minimizing ecological impacts, and improving public health outcomes from MassDOT's operations and planning processes.

Healthy Transportation Compact
The Healthy Transportation Compact interagency initiative brings together the state departments of Health and Human Services, Energy and Environmental Affairs, the Commissioner of Public Health, the MassDOT Highway Division and the MassDOT Rail and Transit Division with the intention of facilitating transportation decisions that balance the needs of all transportation users, expand mobility, improve public health, support a cleaner environment and create stronger communities. Actions include facilitating better accommodations for those with mobility limitations; increasing opportunities for physical activities; increasing bicycle and pedestrian travel through additional, safer, and better connected bicycle and pedestrian infrastructure; a statewide complete streets policy; implementing health impact analyses for transportation decisions; and the federal Safe Routes to School program.

Massport activities at Logan Airport will support the Healthy Transportation Compact through its ongoing development of the Southwest Service Area and North Cargo Area. The projects include an improved pedestrian environment for employees, neighborhood residents, and visitors. Streetscape improvements and new pedestrian and bicycle routes strengthen connections between the neighborhood, terminals; airport buffers; mass transit and the Harborwalk (a multimodal off-road path); Bremen Street Park and the Greenway Connector; as well as the Logan Office Center and the on-Airport shuttle bus. Pedestrian actuated crossings are planned at signalized intersections along Harborside Drive and sidewalks provided along Harborside Drive, Jeffries Street, and Porter Street. Midblock crossings or crosswalks at unsignalized intersections will consider street and pedestrian level lighting, as well as advanced warning signs and/or systems, as necessary. As described previously, bicycle access and parking is planned in secured locations for public and employee use.

South Boston Waterfront Transportation Plan
Massport, the City of Boston, Massachusetts Department of Transportation, and the Massachusetts Convention Center Authority, all participated in and manage the new sustainable transportation plan for the South Boston Waterfront. The resulting Plan, featuring an unprecedented collaboration of the private and public sectors, is a blueprint for improving the growth of the Waterfront, proposing real solutions to meet the growing and changing transportation needs of the district, improve the public realm of the area, all while preserving the quality of life for the surrounding neighborhoods.

The Plan benefitted from the input of area stakeholders through five community meetings and more than 50 outreach meetings throughout the process. We see its completion as the beginning of continued collaboration to refine and implement Plan recommendations.

36 "Draft GreenDOT Implementation Plan." Massachusetts Department of Transportation. June 2012.

Boston Metropolitan Planning Organization (Boston MPO)
Massport supports multimodal transportation planning and improving integration with its facilities through its permanent voting membership on the Boston MPO, providing input on policy and programming decisions.

MPOs are established in large metropolitan areas and are responsible for conducting a federally required cooperative, comprehensive, and continuous metropolitan transportation planning process. Based on this planning, MPOs determine which surface transportation system improvements will receive federal capital (and occasionally, operating) transportation funds. The Boston MPO′s mission is to establish a vision and goals for transportation in the region and then develop, evaluate, and implement strategies for achieving them.

Massport plays an active role on the MPO's decision-making board, participating in policy decisions related to the Long-range Regional Transportation Plan and project programming for the Transportation Improvement Program. The MPO also guides the work conducted by Central Transportation Planning Staff (CTPS) via its Unified Planning Work Program. CTPS are occasionally used by Massport to support its ground transportation planning initiatives.

Metropolitan Area Planning Council (MAPC)
Massport is also an ex-officio member of MAPC, which is a regional planning agency serving the people who live and work in Metropolitan Boston. The MAPC mission is to promote smart growth and regional collaboration, which includes protecting the environment, supporting economic development, encouraging sustainable land use, improving transportation, ensuring public safety, advancing equity and opportunity among people of all backgrounds, and fostering collaboration among municipalities. MAPC membership includes 101 municipal government representatives, 21 gubernatorial appointees, 10 state officials (including Massport), and three City of Boston officials. A staff of approximately 40 individuals supports the Council and its Executive Committee of 25 selected members. Massport was not an executive committee member in 2014.

Summary of Regional Long-Range Transportation Planning Efforts

The aim of regional transportation planning efforts is to reduce reliance on Logan Airport, and to provide New England travelers with a variety of viable transportation options. The NERASP study conducted in 2006 has helped to develop the primary commercial airport system in New England in order to support these benefits. Meanwhile, the NEG/ECP works to coordinate the highway, aviation, freight, and commuter rail transportation networks. Rail service such as the Amtrak Northeast Corridor and proposed improvements such as the Boston-South Station Expansion, also help to balance the passenger load among various forms of transportation. Other supporting planning forums include GreenDOT, the Healthy Transportation Compact, and Boston MPO.

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Ground Access to and from Logan Airport

Introduction

This chapter describes Massport's achievements in diversifying and enhancing ground transportation options (for passengers and employees) to minimize impacts to the transportation system and environment, while providing air passengers with as many alternatives as possible for convenient travel to and from the Airport. Massport's comprehensive ground transportation strategy is designed to maximize transit and shared-ride options for travel to and from Logan Airport and minimize vehicle trips by providing convenient transit, shuttle, and pedestrian connections at the Airport.

In addition to highlighting recent changes to ground transportation services, operations, and pricing, this chapter reports on ground access conditions and activity levels in 2014, which are compared to past conditions. Activity levels include measures of ridership, traffic volumes, and parking demand and its impacts under Logan Airport's constrained parking supply.[1]

Despite Massport's industry-leading efforts promoting and providing high occupancy vehicle (HOV)/ shared-ride mode use, private passenger vehicle trips continue to increase with growth in air travel. As Logan Airport air traveler numbers have increased, a constrained parking supply at Logan Airport has resulted in an increase in "pick-up/drop-off" vehicle trips. The greater number of vehicle trips means increasing vehicle miles traveled (VMT) and attendant emissions – the opposite effect of what the Logan Airport Parking Freeze[2] regulation was intended to achieve.

Massport remains concerned that a constrained parking supply at the Airport will continue to cause an increase in both vehicle trips and curbside congestion due to pick-up/drop-off activity by private vehicles. These trips increase automobile emissions both locally and regionally, which is contrary to the intended air quality goals of the Massachusetts State Implementation Plan (SIP).[3] As part of its Long-Term Parking

1 *Appendix G,Ground Access* includes additional figures.
2 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.
3 The Clean Air Act requires states to develop a general plan to attain and maintain the National Ambient Air Quality Standards (NAAQS) in all areas of the country and a specific plan to attain the standards for each area designated nonattainment for a NAAQS. These plans, known as State Implementation Plans or SIPs, are developed by state and local air quality management agencies and submitted to EPA for approval.

Management Plan, Massport is considering a series of remedies to minimize increases in this type of pick-up/drop-off activity.

Improving the multimodal connectivity of the Airport can provide traffic and environmental benefits by reducing vehicle trips, miles traveled, and greenhouse gas (GHG) emissions associated with travel to and from Logan Airport. The cost, speed, convenience, safety, and attractiveness of all modes of transportation connecting to the Airport affect how passengers and employees choose among these access modes. Offering a range of multimodal transportation options also reduces transportation costs and improves customer service for air passengers, employees, and other Airport users.

Regional transportation efforts, as they relate to the Airport and planning efforts to diversify transportation options in the New England region (primarily through commuter, passenger, and high-speed rail), are discussed in *Chapter 4, Regional Transportation.*

2014 Ground Access Highlights and Key Findings

- Massport has continued to invest in and operate Logan Airport with a goal of increasing the number of passengers arriving by transit or other HOV/shared-ride modes. Logan Airport continues to rank at the top of U.S. airports in terms of HOV/transit mode share. The 2013 Logan Airport Air Passenger Ground Access Survey found that 28 percent of air passengers use HOV/shared-ride modes to access the Airport. Massport continues to provide and actively promote HOV/shared-ride options to air passengers, including Logan Express bus service, free Silver Line boardings, water shuttle service, and free, frequent shuttle bus service to and from the Blue Line subway station.
- In 2014, VMT on-Airport decreased by 10.5 percent. The substantial decrease in on-Airport VMT is reflective of Massport's efforts to reduce VMT through the opening of the Rental Car Center (RCC), which: (1) consolidated rental car operations to one location; (2) provides one unified rental car shuttle; (3) relocated the taxi and limousine/bus pool closer to terminal area roadways; and (4) included additional improvements to alternative transportation systems. Now that these changes have been made, it is expected that VMT should grow at roughly the same pace as gateway traffic volumes. However, given that gateway traffic volumes grew by 5.3 percent in 2014 and corresponding parking activity grew by only 1.3 percent, trends indicate that vehicle pick-up/drop-off activity (and associated VMT to the Airport) is increasing at a much faster rate.
- Since 2000, the highest average weekday VMT estimated at Logan Airport was in 2007, when VMT was 184,613. Although VMT was estimated at significantly lower levels in 2014 (as discussed below), a direct comparison between values cannot be made. The current VMT model (adopted in 2011) includes a substantially bigger on-Airport study area than the previous model, which was limited to terminal access roads only. Therefore, VMT reduction is potentially understated.
- Massport continued to be in full compliance with the Logan Airport Parking Freeze regulations throughout 2014. Despite an increase in terminal area parking rates on July 1, 2014, daily parking demand more frequently approached the Parking Freeze cap in 2014. Massport is consolidating 2,050 temporary parking spaces in an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all remaining spaces permitted under the Logan Airport Parking Freeze.
- As air passenger levels have reached over 30 million, Logan Airport faces real challenges managing demand for on-Airport parking, resulting in a growing number of days in which arriving vehicles are

diverted or moved to non-garage parking areas on (and sometimes off) the Airport. Increases in weekday peak commercial parking demand places additional pressure on roadway and parking operations under the Logan Airport Parking Freeze. In 2014, for example, due to high demand on Tuesdays, Wednesdays, and Thursdays, 30,314 cars were diverted to another garage or lot and 56,634 cars were valeted/stacked (when cars are parked in aisles, have their keys taken, and then are re-parked in empty spaces as they become vacant); this represents over a 50-percent increase since 2013. There were about 40 weeks in which one or more of these measures were put into effect in 2014.

- The constrained parking supply at Logan Airport has led to an increase in the pick-up/drop-off activity at the Airport. Pick-up/drop-off is the least desirable mode choice since it can generate up to four vehicle trips per air passenger trip.[4] As mentioned above, Massport is considering options to address this situation.

Ground Transportation Modes of Access to Logan Airport

For the purposes of tracking ground-access mode share over the years, Massport defines the following modes:

HOV (Shared-Ride) Modes

- Public transit (Blue Line rapid transit, Silver Line bus rapid transit, MBTA bus, and water transportation);
- Logan Express scheduled bus service;
- Scheduled buses and vans;[5]
- Courtesy shuttle buses;
- Charter buses; and
- Unscheduled private limousines and vans.

Non-HOV (Automobile) Modes

- Private Autos;
- Taxis (regardless of the number of passengers in a vehicle); and
- Rental Cars.

4 For example, if an air passenger is dropped off by a friend when they depart on an air trip and is picked-up by a friend when they return, that single air passenger generates a total of four ground-access trips: two for the drop-off trip (one inbound to Logan Airport, one outbound from Logan Airport) and two for the pick-up trip (one inbound to Logan Airport, one outbound from Logan Airport).

5 Includes ride-booking services such as Uber and Lyft.

Although private automobiles, taxis, and rental cars often carry multiple occupants, they are not categorized as HOV modes.[6] The *Ground Access Planning Considerations* section later in this chapter includes further discussion of the Logan Airport HOV mode share goal.

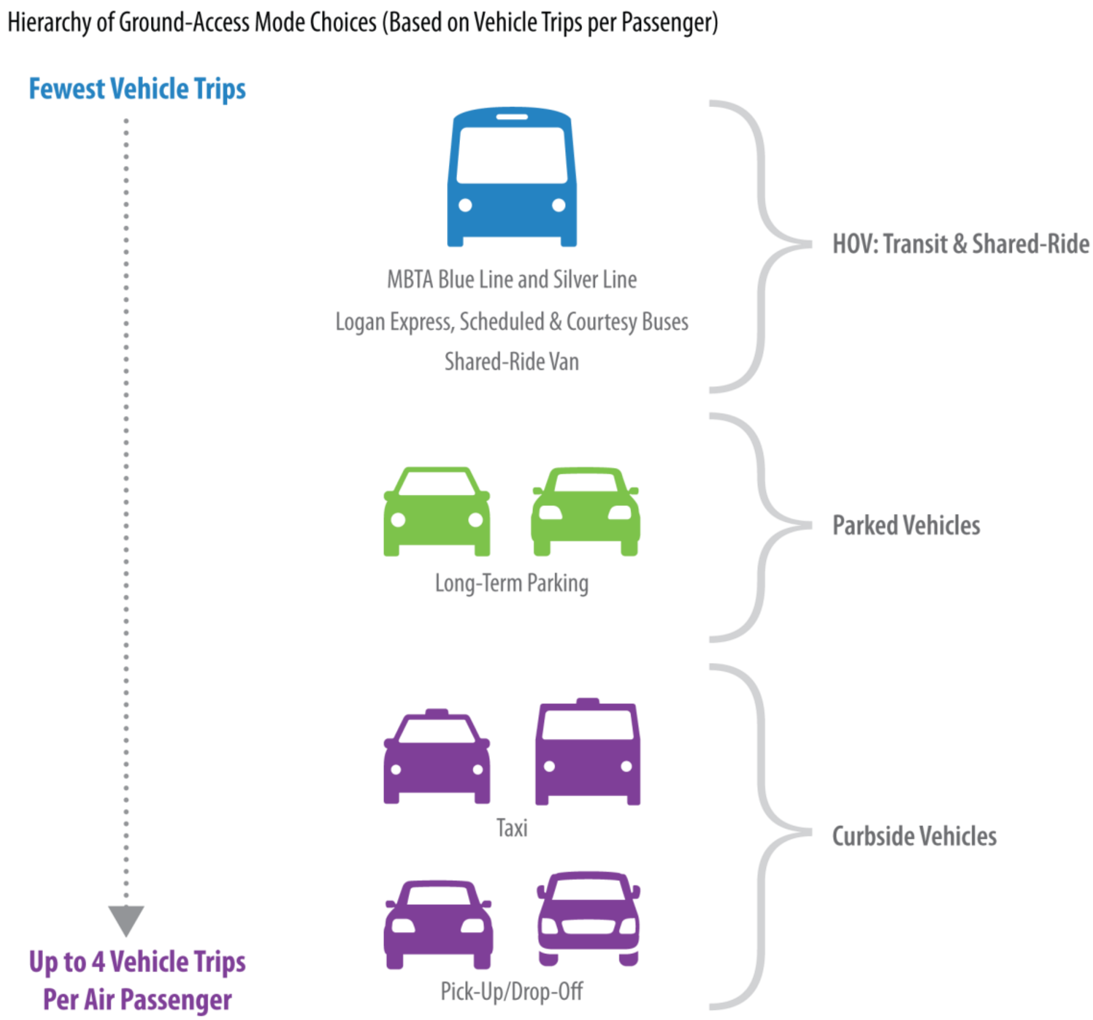
Massport has been rethinking the relationship between the different ground access modes and focusing on the trip generation associated with these modes. Air passengers have three major options for getting to Logan Airport: (1) transit, HOV or shared-ride service; (2) drive to Logan Airport and park; or (3) pick-up/drop-off mode, which can involve a private vehicle, taxi, limousine or taxi alternative. In this categorization, the major "modes" are:

- Transit and shared-ride:
  - MBTA services (Blue Line, Silver Line);
  - Massport services (Logan Express); and
  - Private operators (scheduled coach express bus, shared-ride vans, courtesy shuttles).
- Private vehicles that are parked for the duration of the trip.
- Vehicles that drop-off or pick-up passengers at the terminal curbs, but do not remain on-Airport:
  - Private vehicles that do not park for the duration of a passenger's trip;
  - Taxicabs; and
  - "Black car" limousines.

As noted in Figure 5-1, transit and shared-ride modes are designed for use by more than one travel party (or multiple travelers). With a higher occupancy, the Airport vehicle trips per passenger for the transit and shared-ride modes is quite low. Private vehicles that park at the Airport (or an off-Airport lot), generate a single vehicle trip to the Airport for the departing passenger (and a single vehicle trip from the Airport for the arriving passenger). Vehicles that do not remain on the Airport for a passenger's trip duration, such as those private vehicles that have dropped off a passenger at the curb, generate a trip to and a trip from the Airport for a departing passenger. In the case of taxicabs and black car limousines, many of them depart Logan Airport empty after dropping off a passenger. As Figure 5-1 shows, when measured in terms of vehicle trips generated, the most environmentally desirable mode is transit/HOV/shared-ride, followed by drive-and-park, with the least desirable mode being pick-up/drop-off.

6 The *2013 Logan Airport Air Passenger Ground Access Survey* indicates that the average occupancy of these automobile modes (private automobiles, taxis, and rental cars) is 1.9 persons per vehicle, indicating that Massport is somewhat conservative in the calculation of HOV/SOV split. The HOV mode share goal is based on modal categories and not on actual vehicle occupancy.

Figure 5-1 Ground-Access Mode Choice Hierarchy



Note: Short-term parking is included under "pick-up/drop-off"

On-Airport Vehicle Traffic: Volumes and Vehicle Miles Traveled (VMT)

This section reports on Logan Airport's traffic-related activity for 2014, specifically:

- Traffic volumes
- VMT calculations

Central to these components is Massport's leadership in and commitment to developing, promoting, and providing alternative means of ground transportation for access to and from Logan Airport. The diverse range of environmentally-responsible transportation modes to access the Airport by air travelers, employees and other Airport users has reduced reliance on automobile travel, thus reducing traffic congestion and contributing to improvements in air quality. Figure 5-2 shows the roadway infrastructure at Logan Airport in 2014.

Gateway Traffic Volumes

Gateway roadways are defined as access points to/from Logan Airport, which include the Route 1A roadway ramps, Ted Williams Tunnel (TWT) (Interstate 90) ramps, Frankfort Street/Neptune Road, and Maverick Street.

Data Collection and Annual Average Daily Calculation Method

All of the Airport's gateway roadways are now equipped with permanent traffic count stations, as part of the Airport-wide Automated Traffic Monitoring System (ATMS). These stations provide data to calculate:

- AADT, annual average daily traffic;
- AWDT, annual average weekday daily traffic; and
- AWEDT, annual average weekend daily traffic.

Since the data are collected continuously throughout the year, seasonal adjustment factors are only necessary when significant gaps in the data occur (typically due to equipment failure/malfunction or construction activity). When seasonal adjustment factors are used, these are based on a combination of the seasonality (monthly variation) of counts from other ATMS stations, air passenger levels, and parking exits. On occasion, traditional automated traffic recorder (ATR) counts are collected to supplement the ATMS data.

Annual Average Daily Activity Levels

Table 5-1 summarizes the daily gateway traffic volumes at Logan Airport for the years 2009 through 2014. It includes AADT, AWDT, AWEDT, and annual air passengers, for reference.

The AADT entering and departing Logan Airport via its gateway roadways increased by 5.3 percent between 2013 and 2014. The change in average daily traffic can be attributed to:

- A 4.7-percent increase in air passenger activity in 2014;
- A 5-percent increase in taxi dispatches in 2014; and
- A 1.3-percent increase in parking activity (exits) in 2014.

Table 5-1 Logan Airport Gateways: Annual Average Daily Traffic, 2010 - 2014

	AADT		AWDT		AWEDT		Annual Air Passengers	
Year	Volume	Percent Change	Volume	Percent Change	Volume	Percent Change	Level of Activity	Percent Change
2010	94,179	5.1%	98,968	5.7%	82,595	4.7%	27,428,962	7.5%
2011	99,449	5.6%	104,863	6.0%	85,879	4.0%	28,907,938	5.4%
2012	99,281	(0.2%)	104, 439	(0.4%)	86,494	0.7%	29,235,643	1.5%
2013	102,771	3.5%	107,656	3.1%	90,822	5.0%	30,218,631	3.4%
2014	**108,172**	**5.3%**	**113,564**	**5.5%**	**94,881**	**4.5%**	**31,634,445**	**4.7%**

Source: Massport
Notes: Numbers in parentheses () represent negative numbers.
AADT Annual average daily traffic.
AWDT Annual average weekday daily traffic.
AWEDT Annual average weekend daily traffic.

Historically, the highest AADT recorded at Logan Airport was in 2007, when AADT was 110,690; AWDT was 119,200; and AWEDT was 91,320. These gateway traffic volumes corresponded to an annual air passenger level of 28,102,455 passengers. These values are 2 to 5 percent lower than current on-Airport traffic volumes despite an almost 12.6-percent increase in passenger levels from 2007 to 2014.

On-Airport Vehicle Miles Traveled (VMT)

On-Airport VMT is calculated as the total number of miles traveled by all vehicles within the Logan Airport roadway system. VMT is an important metric because it is used to calculate motor vehicle air quality emissions, and it is one indication of the traffic levels on roadways within specific areas and at specific times.

Calculation Method and Model Description

In 2011, Massport began using its on-Airport VISSIM[7] model to estimate VMT. This model can be adapted to reflect changes in the evolving Logan Airport roadway transportation network and is more robust than the previous model developed in 1994 and based on the prior terminal roadway system. The VISSIM model was developed for a larger study area than the original VMT model, which only focused on the major Airport gateways, the circulation roadways, and the terminal areas. The VISSIM model now accounts for a larger on-Airport study area from Lovell Street and the North Cargo Area (NCA) to Harborside Drive and the South Cargo Area (SCA), and includes the Southwest Service Area (SWSA). The overall VMT growth due to the slightly larger study area is negligible. The study area of the VISSIM model roadway network can be found in *Appendix G, Ground Access*. The VISSIM model not only estimates VMT associated with curbside activity and parking, but also with Logan Airport operations, rental car activity, and hotel activity.

The model was modified for 2014 to include the following changes:

- The addition of the RCC building and associated roadway infrastructure;
- The relocation of the taxi and bus/limo pools; and
- Curbside reallocations at all terminals in support of the RCC.

These modifications changed vehicle routes, eliminated individual rental car vendor shuttles, and added a unified shuttle to RCC and Airport Station. While the RCC was open and fully operational throughout 2014, some of the related changes (such as relocation of the taxi and bus/limo pools) were not made until the end of the year. Reallocation of annual average volume data, particularly in the NCA, were estimated to reflect the full set of modifications.

The model was calibrated to existing evening (PM) peak hour volume data to improve the accuracy of the results. Adjustment factors were determined to calculate morning, highest 8-hour, and average weekday VMT from the updated VISSIM model. The adjustment factors for the 2014 VMT calculations were determined by using 2011 to 2014 gateway, Airport roadway, and parking volume averages. Tables provided in *Appendix G, Ground Access* compare existing and simulated traffic volumes at Logan Airport for the 2014 condition.

7 PTV America. (2011). Verkehr In Städen Simulationsmodell- VISSIM version 5.40 [computer software]. Portland, OR.

Estimated VMT Calculations and Modeling Results

Consistent with previous years, the following specific time periods were analyzed for 2014:

- Morning peak hour (AM Peak Hour);
- Evening peak hour (PM Peak Hour);
- Highest consecutive 8-hour (High 8-Hour); and
- Average AWDT.

Table 5-2 summarizes the VMT estimates for Logan Airport-related traffic from 2010 through 2014. From 2013 to 2014 the VMT decreased by 10.5 percent, despite a 5.5-percent increase in AWDT. Since 2010, the weekday VMT has decreased by 2.7 percent, while air passenger and traffic volume grew by 15.3 percent and 14.8 percent, respectively, for the same time period. The decrease in VMT is reflective of Massport's efforts to reduce VMT by consolidating rental car operations to one location (on-Airport in the SWSA); eliminating each rental car vendor shuttle and providing one unified shuttle; relocating the taxi and limousine/bus pool closer to terminal area roadways; and additional improvements to alternative transportation systems. Now that these operational changes have been made, it would be expected that VMT would grow at the same pace as gateway traffic volumes. However, given that gateway traffic volumes grew by 5.3 percent in 2014 and corresponding parking activity grew by only 1.3 percent, trends indicate that pick-up/drop-off activity (and associated VMT) is increasing at a much faster rate.

Details of the 2014 VMT modeling results are presented in *Appendix G, Ground Access.*

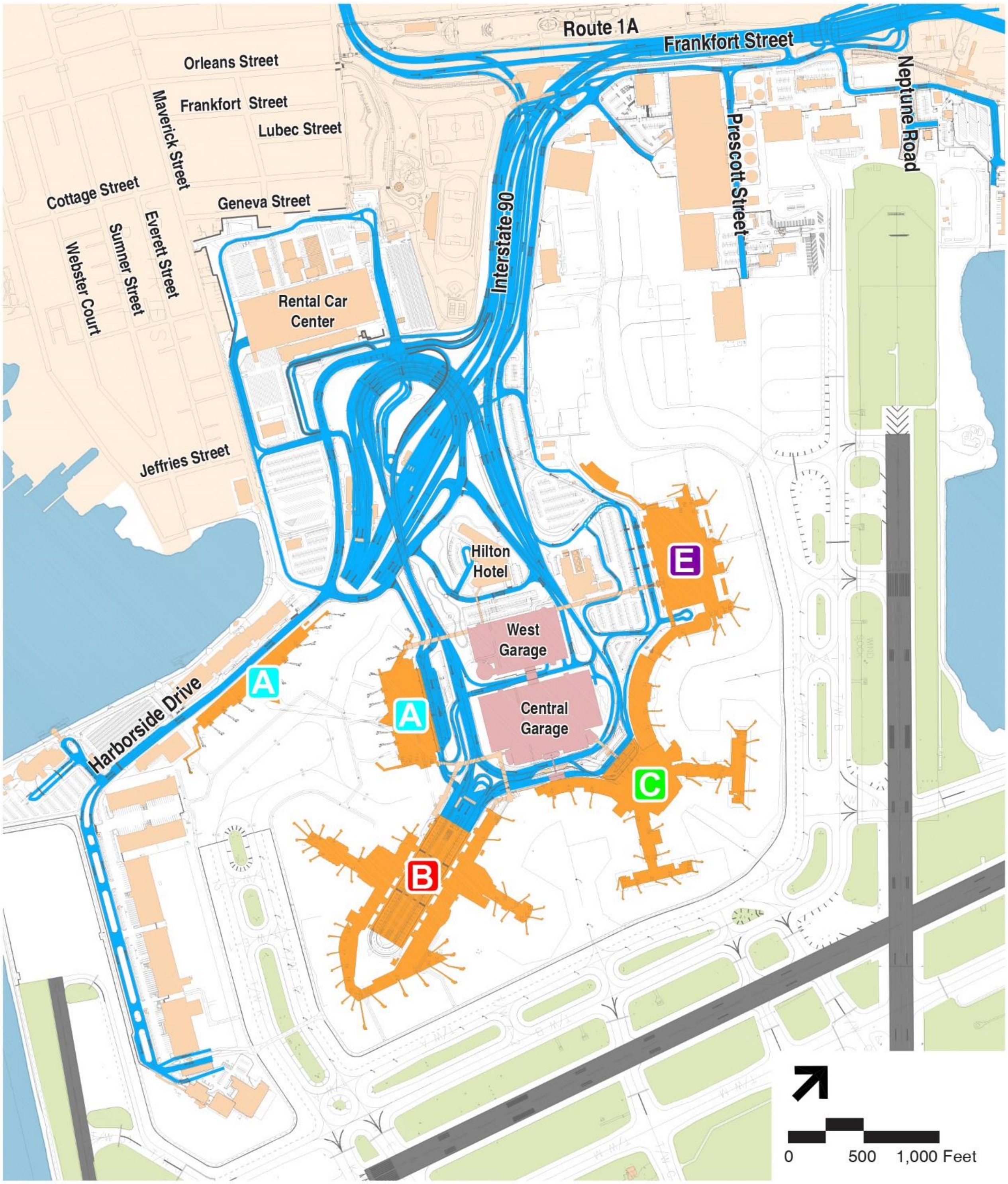
Table 5-2 Airport Study Area Vehicle Miles Traveled (VMT) for Airport-Related Traffic, 2010 - 2014

Analysis Year	AM Peak Hour	PM Peak Hour	High 8-Hour	Average Weekday	Average Weekday Percent Change
2010 (VMT model)	8,451	10,887	78,185	162,885	4.8%
2011 (VISSIM model)	8,391	10,978	76,920	167,647	2.9%
2012 (VISSIM model)	8,387	10,974	76,883	167,564	(0.05%)
2013 (VISSIM model)	9,006	11,407	80,088	177,094	5.7%
2014 (VISSIM model)	**8,155**	**10,107**	**71,361**	**158,443**	**(10.5%)**

Source: VHB and Massport.
Note: Numbers in parentheses () represent a reduction in VMT.
As discussed above, the 10.5-percent decrease in VMT can be attributed to the addition of the RCC, relocation of the taxi and bus/limo pools, and terminal curbside reallocations in support of the unified shuttle.

Since 2000, the highest average weekday VMT estimated at Logan Airport was in 2007, when VMT was noted to be 184,613. Although VMT was estimated at significantly lower levels in 2014, a direct comparison between values cannot be made. The current VMT model (adopted in 2011) includes a substantially bigger on-Airport study area than the previous model, which was limited to terminal access roads. Therefore, VMT reduction due to the infrastructure improvements Massport has invested in over the past 15 years is potentially understated.

Figure 5-2 Logan Airport Roadway Network, 2014



Parking Conditions

This section reports on Massport's monitoring and management of:

- On-Airport parking conditions, including parking facilities and supply, demand, and parking rates; and
- Parking programs (including preferred parking for hybrid vehicles).

Massport manages the on-Airport parking supply at Logan Airport to: (1) promote long-term rather than short-term parking (thus reducing the number of daily trips to Logan Airport); (2) support efficient utilization of parking facilities; (3) provide good customer service; and (4) comply with the provisions of the Logan Airport Parking Freeze. Details on current conditions are presented in the following sections.

Logan Airport Parking Freeze[8]

The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30), which is an element of the Massachusetts State Implementation Plan (SIP) under the Federal Clean Air Act (42 U.S.C. §7401 et seq. [1970]). As required, Massport submits semi-annual filings to the Massachusetts Department of Environmental Protection (MassDEP) demonstrating Massport's compliance with the Logan Airport Parking Freeze. The reports for March and September of 2014 are provided in *Appendix G, Ground Access.*

The Logan Airport Parking Freeze sets an upper limit to the supply of commercial and employee parking spaces at Logan Airport. As permitted (and encouraged) by the Parking Freeze provisions, Massport has converted employee spaces to commercial spaces, within the overall limit imposed by the Parking Freeze. As explained in Table 5-3, Massport has also transferred Airport-related park-and-fly spaces from the East Boston Parking Freeze[9] to the Logan Parking Freeze. Table 5-3 presents the total number of parking spaces permitted on-Airport and the allocation of those spaces as between commercial and employee spaces.

Under the Parking Freeze regulations, Massport must monitor the number of commercial and employee vehicles parked on-Airport and ensure that the total numbers of parked commercial and employee vehicles do not exceed the Parking Freeze limits. If the number of commercially parked vehicles exceeds the allocated commercial parking limit under the freeze on any day, those additional vehicles are considered to be using "Restricted Use Parking Spaces." Use of Restricted Use Parking Spaces is allowed under the regulation when Logan Airport experiences "extreme peaks of air travel and corresponding demand for parking spaces" and may be made available for use only at such times, up to ten days in any calendar year, and must be provided free of charge when demand exceeds the limit. Additional information on parking demand and conditions under constrained parking is provided later in this section.

8 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.
9 310 Code of Massachusetts Regulations 7.31.

Table 5-3 Logan Airport Parking Freeze: Allocation of Parking Spaces

Year	Type of Spaces		
	On-Airport Commercial Spaces	On-Airport Employee Spaces	Total Logan Airport Spaces Permitted
1992 - 1994	12,215	7,100	19,315
1995 - 1997	12,890	6,425	19,315
1998 - 2000	14,090	5,225	19,315
2001 - 2006	15,467	5,225	20,692[1]
2007 - 2010	17,319	3,373	20,692
2011 - 2012	18,019	2,673	20,692
2012 - 2013	18,265	2,673	20,938[2]
2013 - 2014	18,415	2,673	21,088[3]

Source: Massport.
1 In 2000, the Massachusetts Department of Environmental Protection and the U.S. Environmental Protection Agency approved an amendment to the Logan Airport Parking Freeze to permit the transfer of 1,377 spaces relocated from the East Boston Parking Freeze Area to the Logan Airport Parking Freeze Area.
2 In July 2012, Massport acquired property at 135B Bremen Street in East Boston, which supported 246 park-and-fly spaces that were in the East Boston Parking Freeze inventory. Massport's relocation of those park-and-fly spaces from the East Boston Parking Freeze Area to the Logan Airport Parking Freeze Area led to a revised Parking Freeze inventory for Logan Airport and East Boston.
3 In June 2013, Massport acquired property at 413-419 Bremen Street in East Boston which had 150 park-and-fly spaces that were located within the East Boston Parking Freeze Area. Massport's relocation of those park-and-fly spaces from the East Boston Parking Freeze Area (shifting space allocation to the Logan Airport Parking Freeze Area) led to a revised Parking Freeze inventory for Logan Airport and East Boston.

The intent of the Logan Airport Parking Freeze is to reduce emissions by shifting air passengers to travel modes requiring fewer vehicle trips. However, by constraining parking on-Airport, survey data has consistently shown that constrained parking has the unintended consequence of shifting air passengers to travel modes with a higher number of vehicle trips, despite Massport's extensive efforts to provide and encourage use of HOV travel modes. According to the *2013 Logan Airport Air Passenger Ground Access Survey,* if parking was not an option for passengers who parked on-Airport, three-quarters would use pick-up/drop-off modes (i.e., dropped off or picked up by private vehicles, taxi, or black car/limousine service). Prior surveys of Logan Airport air passengers have consistently shown this same result.

Parking Space Availability Changes

Table 5-4 provides a summary of the Logan Airport commercial parking space inventory.

Daily Parking Occupancy

On-Airport commercial parking occupancy typically peaks mid-week (Tuesday through Thursday) with lower occupancies occurring on other days. The number of vehicles parked at Logan Airport in commercial spaces over the course of any 24-hour period was obtained from parked vehicle count data for Tuesdays, Wednesdays, and Thursdays, which are collected throughout the year. The peak daily parking occupancy data are presented in Figure 5-3.

Table 5-4 Logan Airport Parking Freeze: Allocation of Commercial Parking Spaces, 2011-2014						
	Number of Spaces					Status
Location and Facility	March 2011	March 2012	March 2013	March 2014	March 2015	
Terminal Area						
Central Garage and West Garage	10,375	10,344	10,396	10,267	10,267	
Terminal B Garage	2,380	2,632	2,553	2,254	2,254	
Terminal E Lot 1	269	269	269	275	243	
Terminal E Lot 2	257	257	251	248	248	
Terminal E Lot 3	229	222	222	219	219	
North Cargo Area (NCA)						
Economy Parking Garage	2,880 *(+666 in temp. lots)*	2,789	2,809	2,809	2,809 *(+832 in overflow lots)*	
Total in-service revenue commercial spaces	**17,056**	**16,513**	**16,500**	**16,072**	**16,872**	Excludes hotel and general aviation (GA) spaces (noted below)
Signature Flight Support (General Aviation)	35	35	35	35	35	
Hotel (Hilton, Hyatt)	505	505	505	505	305	One Hilton lot eliminated for West Garage expansion
Total in- service commercial spaces	**17,596**	**17,053**	**17,040**	**16,612**	**17,212**	Includes hotel and GA spaces
Total commercial spaces (Freeze limit) [1, 2]	**17,619**	**18,019**	**18,265**	**18,415**	**18,415**	Includes in-service and designated spaces

Source: Massport, Parking Freeze Inventory, March 2011, March 2012, March 2013, March 2014, and March 2015.

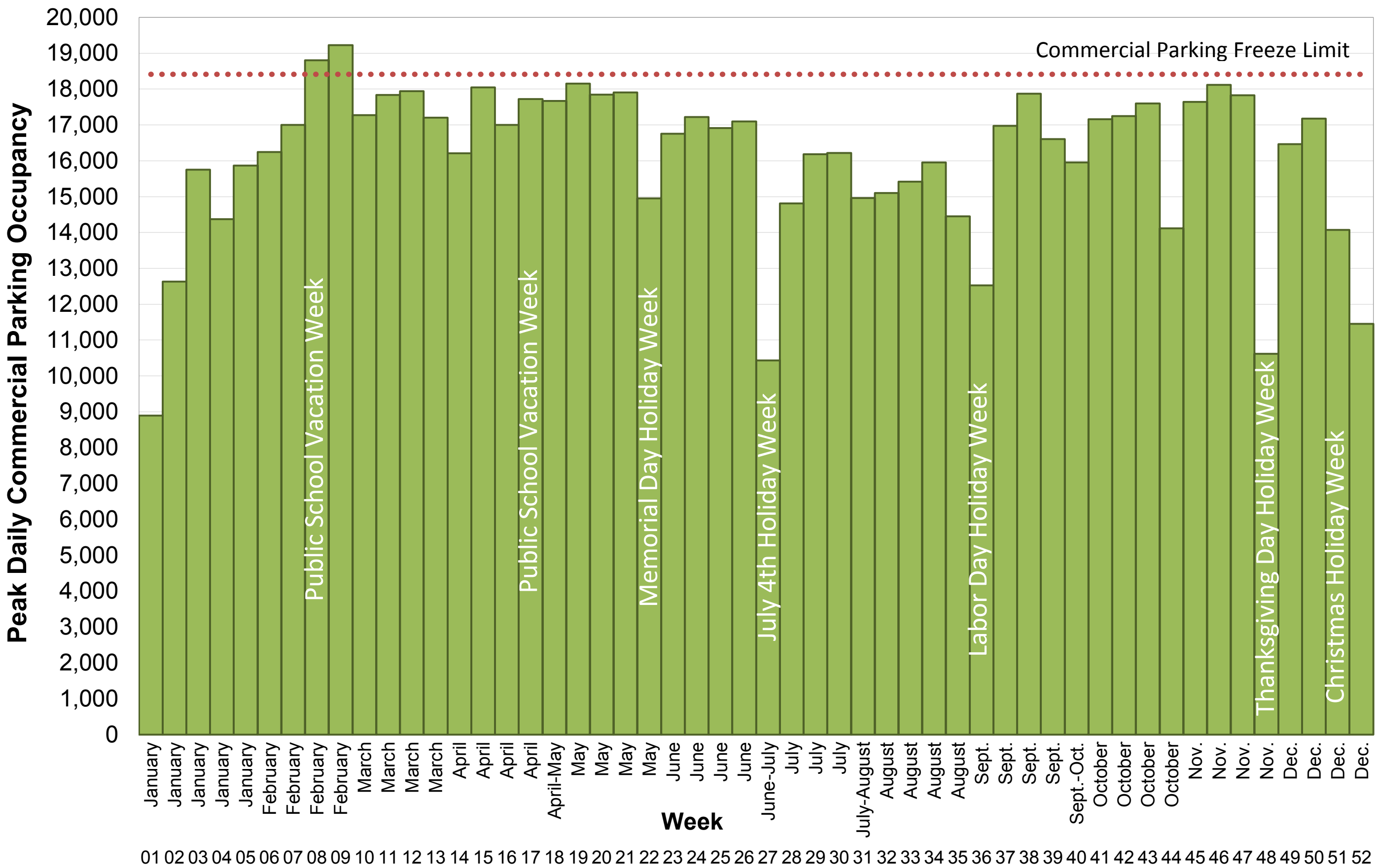
1 In July 2012, 246 spaces were transferred from the East Boston freeze allocation to the Logan Airport Commercial Parking Spaces inventory through the acquistion of Paul's Parking at 135B Bremen Street.

2 In June 2013, 150 spaces were transferred from the East Boston Freeze Area to the Logan Airport Parking Freeze Area through the acquistion of Paul's Parking at 413-419 Bremen Street.

Peak day demand for on-Airport parking has been increasing, resulting in daily demand frequently nearing the Logan Airport Parking Freeze cap (see Figures 5-3 and 5-4). Massport continued to be in full compliance with the Logan Airport Parking Freeze[10] throughout 2014. Massport diverted or valet-parked passenger vehicles 103 out of 260 working days. Vehicle diversions primarily occurred on Tuesdays and Wednesdays, during hours of peak parking demand. Activity in 2014 seems to indicate that peak day parking demand has not dampened despite the July 2014 parking rate increases for on-Airport parking.

10 310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120.

Figure 5-3 Commercial Parking: Weekly Peak Daily Occupancy, 2014

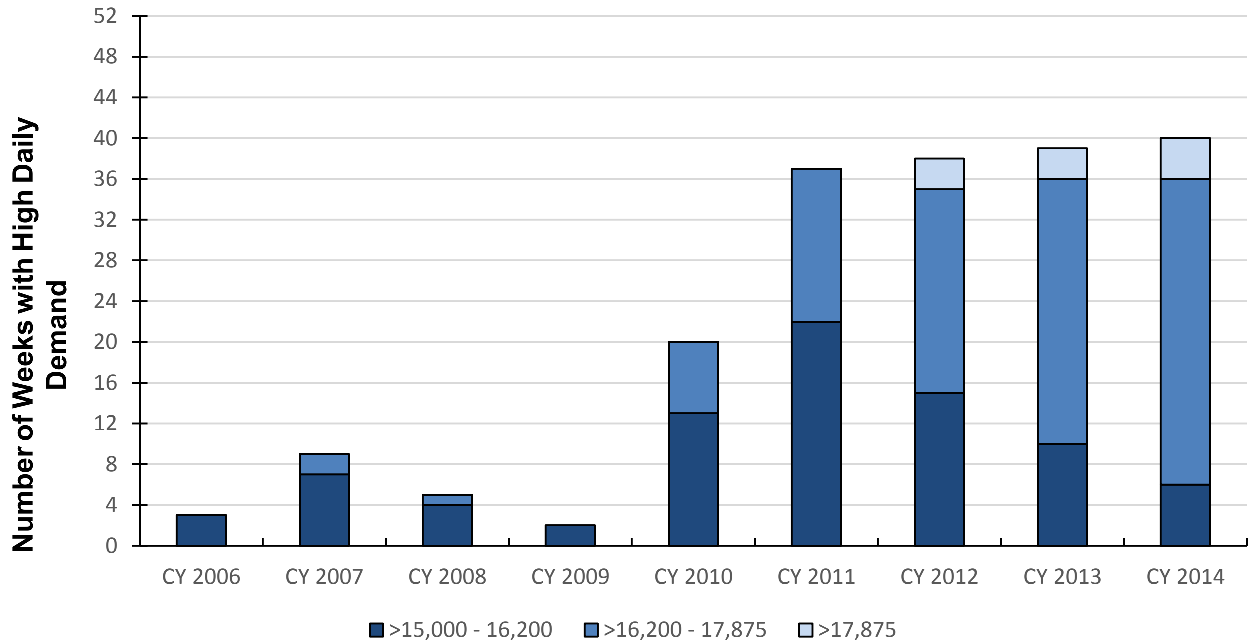


Source: Massport.
Notes: The chart shows the highest daily count for each week in 2014.
Since June 2013, the maximum number of commercial parking spaces permitted by the Logan Airport Parking Freeze is 18,415.
At no time in 2014 did the Parking Freeze limit on Restricted Use Spaces exceed the allowed 10 days. Massport was at all times in full compliance with the Parking Freeze regulations in 2014.

Operational Adjustments to Meet Parking Demand

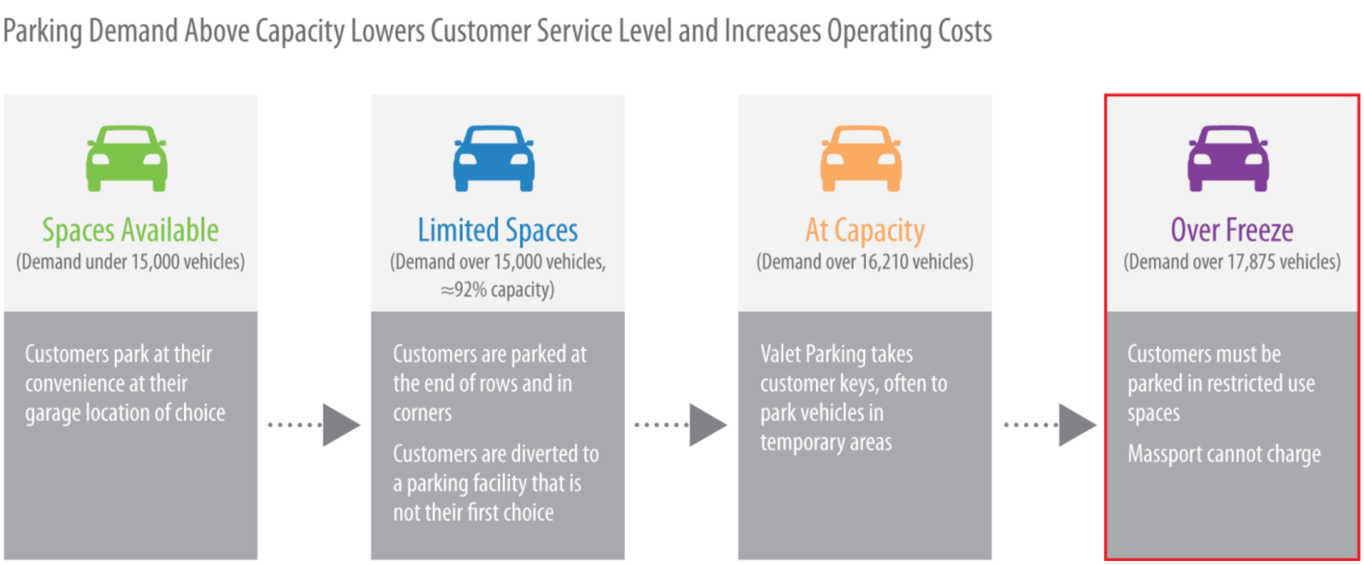
The inadequate supply of parking causes air passengers to circulate on Airport roadways to find parking, and in overflow conditions, cars are diverted or moved to non-garage parking areas, including overflow lots, some at off-Airport parking locations. Not only does parking demand activity above capacity lower customer service levels, it also increases on-Airport roadway vehicle emissions related to circulating traffic. Diversions and valeting have become a regular occurrence at Logan Airport. These diversions decrease operational efficiency and compromise customer service.

Figure 5-4 Demand for Parking: Number of Weeks per Calendar Year with High Daily Parking Demand



Source: Massport

Figure 5-5 Parking Demand and Capacity



Source: Massport
Note: 17,875 represents the spaces within the parking freeze allocated to airport users and subtracts hotel and general aviation uses from the commercial parking freeze limit.

The number of diverted and valeted vehicles has increased significantly over the past several years, approaching 90,000 annually in 2014. These vehicle diversions increase on-Airport VMT. The peak of valet operations coincides with peak parking demand, requiring Airport operations to maximize available space to meet parking demand.

Parking Exits by Duration

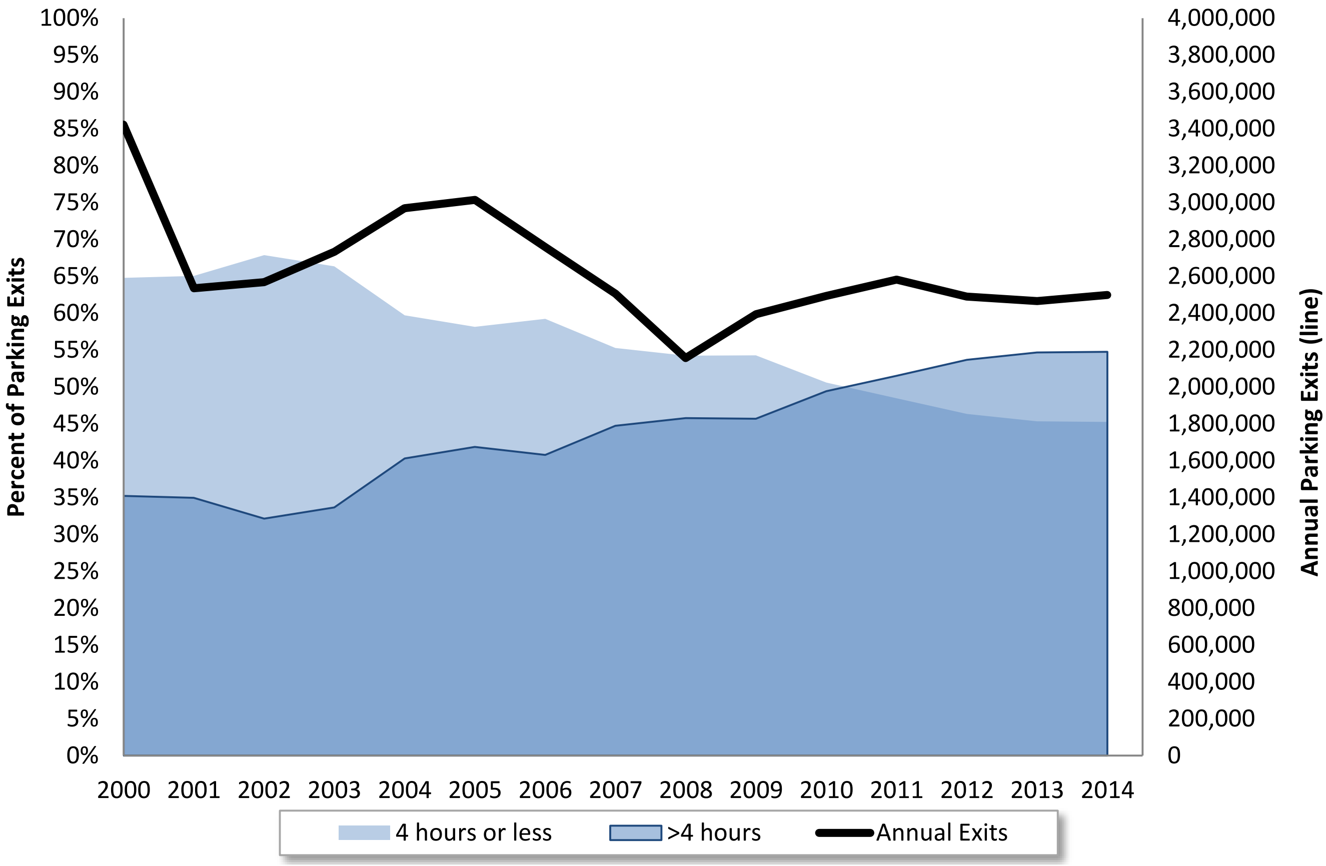
Both peak-day parking demand as well as total annual parking activity (as defined by revenue parking exits) have increased since 2013, as presented in Table 5-5. The distribution of parking exits by length of stay have stayed relatively constant between 2014 and 2013, with a 1.3-percent increase since 2013 (Figure 5-6). The trend for the last few years has been to have vehicles generally parked for longer durations than in the past. This increase in parking duration likely contributed to a lower turnover of parking spaces, and therefore resulted in the higher peak days as shown earlier in Figure 5-3.

Table 5-5 Parking Exits by Length of Stay (Parking Duration)

		0-4 hrs.	>4-24 hrs.	>1-4 days	>4 days	Total
2010	Tickets	1,261,813	230,260	741,706	260,240	2,494,019
	Percent	51%	9%	30%	10%	
2011	Tickets	1,251,956	235,039	800,188	295,270	2,582,453
	Percent	48%	9%	31%	11%	
2012	Tickets	1,153,781	215,028	815,266	305,925	2,490,000
	Percent	46%	9%	33%	12%	
2013	Tickets	1,118,218	209,437	823,187	315,295	2,466,137
	Percent	45%	8%	33%	13%	
2014	**Tickets**	**1,130,560**	**213,567**	**830,545**	**324,332**	**2,499,004**
	Percent	45%	9%	33%	13%	
Percent change – 2013 to 2014		**1.1%**	**2.0%**	**0.9%**	**2.9%**	**1.3%**

Source: Massport.

Figure 5-6 Percent of Parking Exits by Duration: Short vs. Long-Term Parking



Source: Massport.

2014 Commercial Parking Rates

One important reason for Massport periodically assessing its parking rate structure is to support its ground access strategy. As detailed in Table 5-6, parking rates in the central parking garage were increased in July 2014, while parking rates for Logan Express remote parking have remained substantially lower than those at Logan Airport. As noted earlier, however, demand for on-Airport parking in the terminal area is not price-sensitive and these parking rate increases have so far failed to dampen parking demand.

With a pay-on-foot system, Massport requires parking fees to be pre-paid at kiosks inside the terminals and garage access points at the pedestrian walkways, thus improving parking exit flow, and reducing vehicle idling and associated emissions at exit plazas. Pay stations are located in the terminals and at the pedestrian entrances to the Central Garage, Terminal B garage, and Terminal E parking lot. Approximately 80 percent of parking patrons use the pay-on-foot system to pre-pay their parking fees before exiting.

Several off-Airport parking facilities, such as PreFlight Airport Parking in Chelsea, are privately owned and operated, and they are outside of the Logan Airport Parking Freeze area. Massport has no control over rates at off-Airport parking lots. The parking rates for the three major off-Airport parking providers (PreFlight, Park Shuttle & Fly, and Thrifty) vary from $15.95 to $20.00 for daily parking and from $96 to $120 for weekly parking.

Table 5-6 On-Airport Commercial Parking Rates, 2010 - 2014

Terminal Area Facility	2010	2011	2012	2013	2014	Economy Parking	2010	2011	2012	2013	2014
Central/West Parking Garage,											
Terminal B Garage,											
Terminal E Lots						**Economy Parking Garage**					
0 to 30 minutes	$3	$3	$3	$3	$3	Daily Rate	$18	$18	$18	$18	$20
31 minutes to 1 hour	$6	$6	$6	$6	$6	Additional days 0 to 6 hours	$9	$9	$9	$9	$10
1 to 1.5 hours	$9	$9	$9	$9	$11	Additional days 6 to 24 hours	$18	$18	$18	$18	$20
1.5 to 2 hours	$12	$12	$12	$12	$14	Weekly Rate (6-7 days)	$108	$108	$108	$108	$120
2 to 3 hours	$15	$15	$17	$17	$19						
3 to 4 hours	$18	$18	$21	$21	$23						
4 to 7 hours	$22	$22	$25	$25	$27						
7 to 24 hours (Daily)	$24	$24	$27	$27	$29						
Additional days 0 to 6 hours	$12	$12	$14	$14	$15						
Additional day(s) 6 to 24 hours	$24	$24	$27	$27	$29						

Source: Massport; most recent rates effective July 1, 2014.

Long-Term Parking Management Plan

As part of its ongoing review of ground access and strategic planning initiatives, Massport has been reviewing recent parking demand trends. That analysis shows that in 2014, Massport diverted or valet-parked private passenger vehicles to various on-Airport locations approximately 103 out of 260 work days. While Logan Airport has experienced diversions in the past, the number of days per year diversions occur has increased over the past several years. As presented in previous EDR/ESPR filings, diverting or valeting cars is inefficient and reduces customer service.

Massport is committed to an aggressive program of ground access and parking management designed to achieve a number of inter-related objectives:

- Minimize the environmental and traffic impacts associated with ground access to Logan Airport;
- Minimize the environmental impacts associated with the operation of Logan Airport;
- Provide excellent customer service to air passengers and others traveling to Logan Airport; and
- Operate the Airport, its road system, and its parking supply as efficiently as possible.

The Long-Term Parking Management Plan, which was first included in the *2012/2013 EDR*, lays out a multi-part strategy for efficiently managing parking supply, pricing, and operations – both at Logan Airport and at Massport-controlled off-Airport locations – to maximize transit/shared-ride ground access while minimizing both drive-and-park and pick-up/drop-off modes. The Plan represents Massport's current strategy to manage parking pricing, supply, and demand within the current Logan Airport Parking Freeze. Table 5-7 describes each parking plan element and progress to date. Massport is actively working to manage Airport parking and encourage the use of multi-occupant vehicle access to Logan Airport. Additional measures are currently under discussion as part of Massport's strategic planning efforts.

The focus of the Long-Term Parking Management Plan is limited to setting out the efforts that Massport has undertaken, and will continue to implement in the future, to manage the supply, pricing, and operation of parking that it controls both at Logan Airport and at Massport-controlled off-Airport locations to achieve its ground access objectives.

Table 5-7 Long-Term Parking Management Plan Elements and Progress

Parking Plan Element	Progress to Date
Parking Supply: • Massport will add revenue-controlled parking spaces in the terminal area to bring supply up to the maximum number of spaces allowed under the Logan Airport Parking Freeze • Work to increase the supply of Massport-controlled off-Airport parking at Logan Express sites	• Massport has begun construction of approximately 2,050 additional spaces at the Central Garage with anticipated completion late 2015. This project is consistent with the Logan Airport Parking Freeze and builds out the maximum number of allowed spaces. • A new 1,100 car parking garage opened in Framingham on April 15, 2015, increasing capacity at that location by approximately 600 spaces.
Parking Pricing: • Discourage air passengers from driving and parking at Logan Airport by ensuring that the least expensive Massport-controlled parking will be provided at remote Logan Express sites • Encourage more efficient use of available on-Airport parking by maintaining a meaningful price differential between rates at the Economy Parking Garage and terminal-area parking garages • Evaluate increased parking prices for terminal-area parking to encourage Airport passengers and visitors to consider transit and shared-ride alternatives	• Massport has reduced parking rates at Logan Express facilities, from $11.00 per day to $7.00 per day. • Massport has maintained a $9.00 per day price differential between terminal-area parking garages ($29.00 per day) and Economy Spaces ($20.00 per day). • Massport implemented a price increase on July 1, 2014 ($2.00 per day increase) raising the near-terminal rate to $29 per day and Economy rate to $20 per day. The rates are scheduled to increase on July 1, 2016 by $3.00 per day.

Table 5-7 Long-Term Parking Management Plan Elements and Progress (Continued)

Parking Plan Element	Progress to Date
Parking Operations: • Work to improve the efficiency of its current system of addressing overflow conditions • Continue to explore other options that could reduce the number of days that Logan Airport operates in an overflow condition, such as a parking reservation system	• To improve the valet operation, Massport will be implementing an automated valet system September 2015.
Parking Demand: • Increase alternative mode options to decrease use of private vehicles	• Implemented new Back Bay Logan Express scheduled bus service in May 2014. • Offered discounted parking and bus fares at all Logan Express locations during peak air travel periods. • Placed signage in all terminals to help promote the use of the regional express bus carriers. Massport supports free outbound Silver Line bus service and allows free fare of Back Bay Logan Express service for MBTA pass holders.
Employee Parking: • Continue to work to reduce the number of Airport employees commuting by private automobile and parking at the Airport by: providing off-Airport parking both near Logan Airport and at Logan Express sites; and implementing measures to enhance employee commuting options.	• Massport provides employee parking in Chelsea with free bus transportation to the Airport. • Massport continues to offer employee rates to encourage the use of Logan Express facilities. • Additional early morning and late night bus service has been added to Logan Express sites to encourage use and better serve Logan Airport employee schedules.

Pedestrian Facilities and Bicycle Parking

Massport has made substantial progress in providing Airport-wide pedestrian access. Sidewalks along Harborside Drive and Hotel Drive connect to the terminals, where a series of overhead, enclosed walkways connect to the Central and West Parking garages as well as the Hilton Hotel. The sidewalks along Harborside Drive, Transportation Way, North Service Road, Maverick Street, and the Harborwalk facilitate pedestrian access to the Airport water shuttle boat dock, MBTA Blue Line Airport Station, and the pedestrian and bicycle pathways at Memorial Stadium Park, Bremen Street Park, and the East Boston Greenway.

Bicycle parking racks are provided at many landside facilities. Generally, these racks are expected to primarily serve employees, but are open for use by air passengers as well. Terminal A, Terminal E, the Logan Office Center, Signature General Aviation Terminal, the Economy Parking Garage, the Green Bus Depot, and Airport MBTA Station all have bicycle racks. The RCC has covered bicycle parking racks for use by both employees and passengers.

Pedestrian and bicycle safety is further enhanced through the design of streetscape, intersections, lighting, and defined vehicle zones with new curbing, crosswalks, sidewalks, plantings, and fencing. Bicycle connections are available around Airport Station, Memorial Park, Bremen Street Park, and the East Boston Greenway. As part of the RCC construction, connections in the SWSA now allow employees and customers of the Airport to arrive via bicycle and park in a secure covered area at the new RCC. Commuters can utilize the unified bus system or pedestrian connections to the terminals. In the North Service Area, connections to/from Bremen Street Park and the Greenway Connector were complete in early 2015. These improvements connect the existing shared-use path to a new, northern connector of the East Boston Greenway. The Logan Airport portion of this connection was completed in July 2014.


Pedestrians along the East Boston Greenway (left) and Bicycle Racks and the Logan Office Center (right).
Source: VHB.

Ground Transportation Ridership and Activity Levels in 2014

This section of the chapter:

- Provides an overview of transportation services available to Logan Airport users from the Boston metropolitan area;
- Reports on 2014 ridership levels and recent historical trends;
- Notes Massport's progress in meeting ground access goals; and
- Reports on Massport's cooperative planning ventures with other transportation agencies in Massachusetts.

Logan Express, MBTA Transit, and Water Transportation Modes

Annual ridership levels for HOV/transit/shared-ride transportation modes serving Logan Airport are summarized in Table 5-8.

Table 5-8 Annual Ridership and Activity Levels on Logan Express, MBTA, and Water Transportation Services, 2010 – 2014

	MBTA Transit		Logan Express Bus			Water Transportation[3]	
Year	Blue Line[1]	Silver Line[2]	Air Passengers	Employees	Total	MBTA Ferry[3]	Private Water Taxis
2010	2,270,241	831,323	644,412	467,020	1,111,432	34,794	54,382
2011	2,277,311	900,359	649,609	536,513	1,186,122	33,403	58,879
2012	2,442,085	906,177	681,040	624,149	1,305,189	31,197	60,840
2013	2,597,306	N/A	733,005	634,693	1,367,698	N/A	70,378
2014	**2,378,965**	N/A	788,151	632,011	1,420,162[4]	N/A	67,479
Percent Change (2013-2014)	(8%)	N/A	8%	0%	4%	N/A	(4%)

Source: Massport
Notes: Numbers in parentheses () represent negative numbers.
N/A Not available.
1 Airport Station fare gate entrances only. Automatic Fare Collection introduced in January 2007. The Bremen Street Park entrance to MBTA Airport Station opened June 2007; station activity is not limited to only Airport-related passengers.
2 Boardings at Logan Airport. Silver Line: 2012 and 2013 values are estimates. No information available for 2014.
3 MBTA Ferry is the Harbor Express F2/F2H service, Quincy/Hull-Logan and Long Wharf. Service from Quincy Fore River was suspended in 2013. Private water taxis includes: City Water Taxi and Rowes Wharf Water Transport.
4 Ridership of 152,892 for the Back Bay Logan Express not included in this total.

Logan Express Bus Service

Massport provides frequent, scheduled, express coach bus service to Logan Airport for air passengers and Logan Airport employees from park-and-ride lots in Braintree, Framingham, Woburn, and Peabody. Full service bus terminals and secure parking are provided at all four locations. In addition, a service from Back Bay, described below, was introduced in April 2014 (May 2014 was its first full month of operation). A new parking facility was opened in Framingham in April 2015 for Logan Express customers. More information related to this facility will be provided in the *2015 EDR*. Figure 5-7 depicts Logan Express bus locations with respect to the regional transportation network.

The round-trip adult fare is $22; reduced fares are offered to seniors, and children under the age of 17 ride free. To encourage greater ridership, a parking rate restructuring went into effect in 2012, which featured lower parking rates at $7 per day (from $11 per day) at Logan Express parking lots. On weekdays and Sunday afternoons/evenings, scheduled half-hour headways are provided between the Braintree, Woburn, and Framingham locations and Logan Airport; one-hour headways are provided at these locations on Saturdays and Sunday mornings. Scheduled bus service to/from Peabody is provided hourly. Service hours for all four locations are roughly 3:00 AM to 1:00 AM the next day.

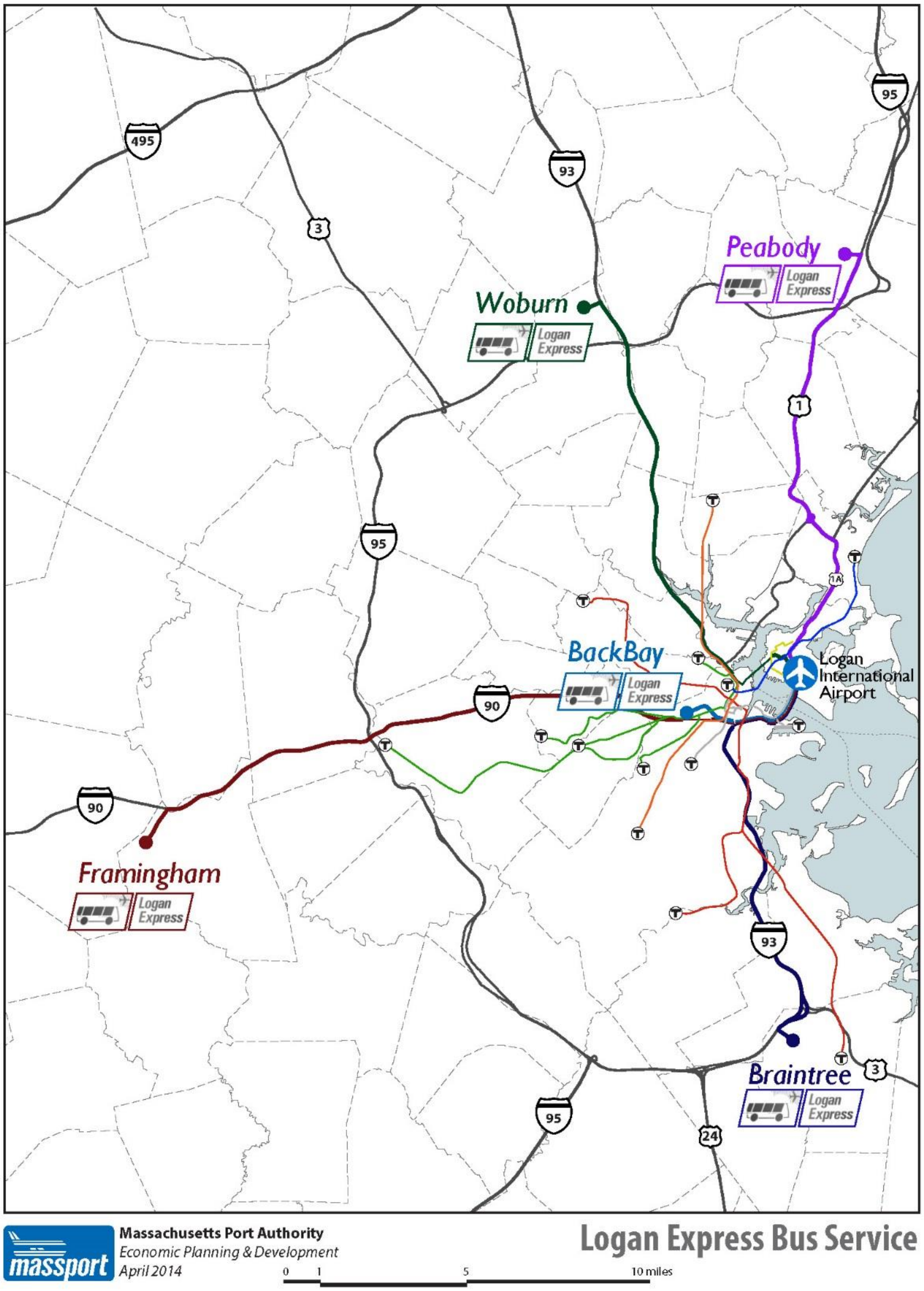
Recent annual ridership trends for Logan Express are shown in Table 5-8. Air passenger ridership on Logan Express increased by approximately 8 percent from 2013 to 2014. Employee ridership stayed roughly the same between 2013 and 2014. A detailed breakdown of the Logan Express ridership is presented in *Appendix G, Ground Access.*

Back Bay Logan Express (Trial Service)

On April 28, 2014, Massport initiated the Back Bay Logan Express service with pick-up locations at the Copley MBTA Green Line Station and the Hynes Convention Center. The Back Bay Logan Express operates daily between the hours of 5:00 AM and 10:00 PM. Fares are $5 per passenger and riders with a current, valid MBTA pass are allowed to ride for free. The goals of the service are to provide an improved service to those transit riders impacted by the Government Center Green Line Station closure (a major transfer point to the Blue Line for Logan Airport passengers and employees) and to increase HOV mode use from the inner Boston area, which generates many vehicle trips. Ridership for the Back Bay Logan Express from April 28 through December 31, 2014, was 152,892 passengers, an average of about 624 riders per day (and a daily high ridership of 1,294 passengers).

Back Bay Logan Express bus.
Source: Massport

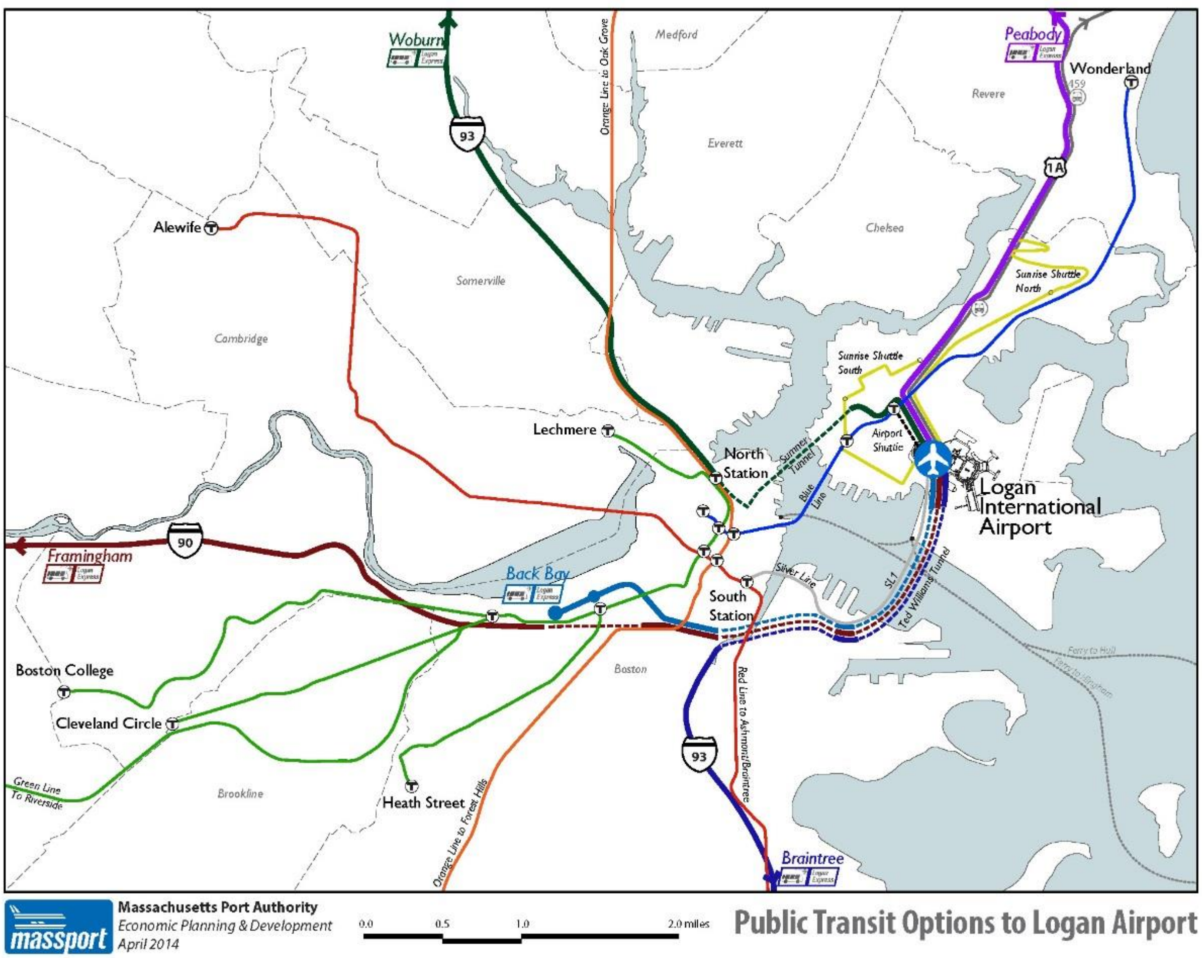
Figure 5-7 Logan Airport – Logan Express Bus Service Locations and Routes, 2014



Rapid Transit

The MBTA provides direct connections to Logan Airport via the Blue Line subway at Airport Station and via the Silver Line bus to each of the terminals. According to the *2013 Logan Airport Air Passenger Ground Access Survey,* these services are used by over 7 percent of Logan Airport's air passengers (almost 17 percent of passengers with trip origins in Boston, Cambridge, Brookline, and Somerville used MBTA public transit to travel to the Airport). Both services are important for reducing automobile travel to the Airport; according to the survey, the majority of users of the Blue Line and Silver Line indicated that their alternative mode of travel to Logan Airport would have been a taxi or they would have been dropped off at the Airport by private vehicle. Figure 5-8 illustrates the public transportation options to access Logan Airport.

Figure 5-8 Logan Airport - Public Transportation Options, 2014



Blue Line Ridership / Airport Station Activity

Fare gate data indicate that nearly 2.4 million riders entered Airport Station in 2014 (see Figure 5-9). This is about an 8-percent decrease compared to 2013. As noted in previous reportings, fare gate data do not distinguish between Airport related riders and East Boston users. Airport passenger ridership levels on the Blue Line can no longer be directly identified as part of the Environmental Status and Planning Report (ESPR)/EDR reporting.[11] Since fare gate data are combined, there is no way of discerning whether the drop in boardings at this station are related to air passengers or East Boston riders.

Silver Line (SL1) Ridership

The Silver Line bus rapid transit service to Logan Airport provides a direct connection between South Station and the Airport terminals via the South Boston Transitway and the I-90 Ted Williams Tunnel (TWT). The introduction of free boardings of the Silver Line Airport buses (SL1) at Logan Airport has eliminated the need for fareboxes; thus, 2014 figures of passenger boardings are not available (see Figure 5-9). Massport is consulting with the MBTA on the potential for Automated Passenger Counting (APC) systems as a means to continue to collect ridership data.

Eight SL1 buses are owned by Massport and are operated by the MBTA with a Massport subsidy. The Silver Line is the only MBTA rapid transit service that provides a direct, one-seat connection to each Airport terminal (the Blue Line requires a second-seat ride on a free Massport shuttle to connect riders to terminals, while express MBTA transit buses connect only at Terminal C, and local bus service to the Airport is very limited). Transfers between the Silver Line and the Red Line at South Station are free. At South Station, passengers may also connect to the MBTA commuter rail, Amtrak, and regional intercity buses.

Water Transportation: Water Taxis and MBTA Ferries

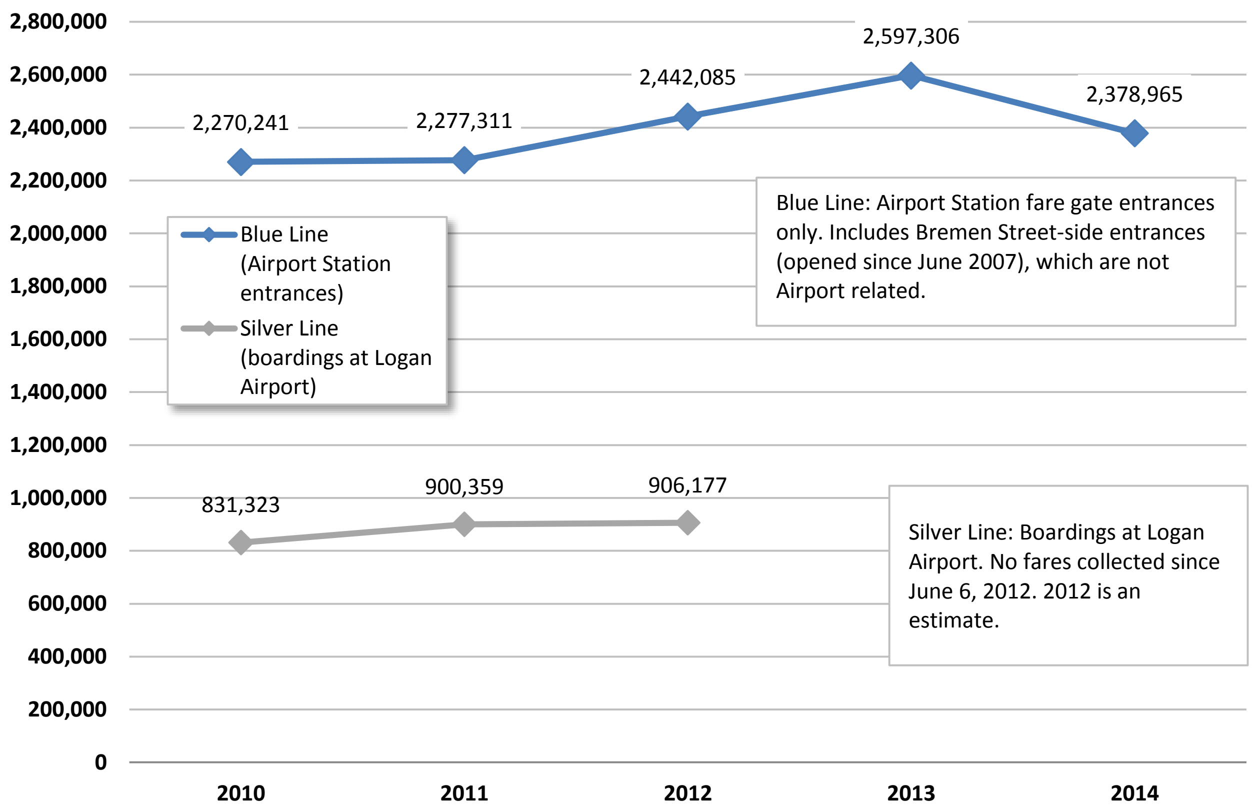
Three companies provide water transportation within the Boston area: City Water Taxi, Rowes Wharf Water Shuttle, and the MBTA's Harbor Express. Collectively, these companies serve numerous destinations throughout Boston Inner Harbor. The water taxi landing locations include: Long, Rowes, and Central Wharfs; the World Trade Center and the Moakley Courthouse in South Boston; Lovejoy Wharf near North Station; and stops in the North End, Charlestown, Chelsea, and East Boston. The MBTA Harbor Express provides services to Long Wharf and destinations outside of the Inner Harbor, including Hingham and Hull.[12] The water transportation services stop at the Logan Airport dock on Harborside Drive. Massport provides a courtesy shuttle bus service between the Logan Airport dock, the MBTA Airport Station, and all Airport terminals. Massport provides an employee subsidy for water transportation modes.

Water transportation accounts for less than 1 percent of the mode share to Logan Airport, according to the *2013 Logan Airport Air Passenger Ground Access Survey*. Annual ridership on privately-provided water transportation experienced a decrease of 4 percent in 2014 compared to 2013 (Table 5-8).

11 Based on automated fare gate entrance counts, approximately 50 percent of entrances occur via the Bremen Street Park fare gates at Airport Station. Based on Massport curbside observations, approximately 45 percent of Airport Station entrances are by airport users.

12 The MBTA ferry schedule from Quincy/Hull to the Logan Ferry Dock is not as frequent as Blue Line and Silver Line services, and does not run on frequent and consistent headways throughout the day. Headways between ferries range from one hour to several hours. There are 14 MBTA ferries to Logan Airport on weekdays, however there are no MBTA ferries direct to Logan Airport from the South Shore during morning commuting times. The one-way fare to cross the Boston Harbor from Long Wharf to Logan Airport costs $13.75, and $17 from Quincy/Hull (twice the regular fare to Boston). The MBTA suspended ferry service from Quincy's Fore River stop in fall 2013, and has since added service to the Hingham service, which has incorporated the Hull stop.

Figure 5-9 Passenger Activity - Blue Line (Airport Station) and Silver Line (SL1), 2010-2014



Source: Massport

Other HOV Modes: Scheduled Buses, Shared-Ride Vans, Courtesy Vehicles, and Limousines

Massport provides priority, designated curb areas at all Airport terminals, to support the use of HOV/transit modes, including privately-operated scheduled buses and shared-ride vans and limousine services. The majority of scheduled shared-ride carriers use a combination of 15- to 40-passenger vehicles and 40+ passenger coach buses. Scheduled express bus service is offered by several privately-operated carriers from outlying areas of the Boston metropolitan area and neighboring states. Shared-ride van services include services between Logan Airport and many hotels in the Greater Boston area. Shared-ride vans also provide service from western Massachusetts and other regional points throughout New England.

As shown in Table 5-9, the use of these HOV modes increased slightly in 2014 compared to 2013, with a switch from the use of scheduled vans and limousines to the use of unscheduled limousines. The use of scheduled buses stayed relatively constant between 2013 and 2014.

Table 5-9 Activity Levels (Estimated Ridership) for Other Scheduled and Unscheduled HOV Modes: Scheduled Buses, Shared-Ride Vans, Courtesy Vehicles, and Limousines, 2010 - 2014

	Scheduled and Unscheduled HOV Modes			
Year	Scheduled Buses	Scheduled Vans & Limousines	Courtesy Vehicles	Limousines *(unscheduled)*
2010	375,223	391,122	635,127	1,035,195
2011	360,237	473,199	594,706	1,095,420
2012	377,608	311,737	653,728	1,199,011
2013	374,792	207,738	646,739	1,168,774
2014	373,138	148,048	651,583	1,506,705
Percent Change (2013-2014)	(<1%)	(29%)	<1%	29%

Source: Massport

Notes: Numbers in parentheses () represent negative numbers.

Ridership is estimated based on dispatched vehicles, according to records from the Logan Airport bus/limousine pool, and the average occupancy per vehicle, according to the ground-access survey.

Scheduled van and limousine service decreased by 29 percent in 2014 while unscheduled limousine service increased by 29 percent. Scheduled service providers have been decreasing the number of trips offered. This trend, in conjunction with ride-booking services like Uber and Lyft, are pushing up unscheduled limousine trips.

Massport offers a 50-percent discount on the ground access fees for alternative fuel vehicles that use compressed natural gas (CNG) or are powered by electricity.

Non-HOV (Automobile) Modes

Logan Airport passengers can access the Airport by a number of automobile modes, including private automobiles, taxis, and rental cars. These modes account for about 72 percent of the access modes used by air passengers, based on the *2013 Logan Airport Air Passenger Ground Access Survey*. Although these modes are categorized as non-HOV, they frequently carry more than one passenger per vehicle. Based on the 2013 survey results, the average vehicle occupancy for these automobile modes is estimated at 1.9 to 2.1 passengers per vehicle.

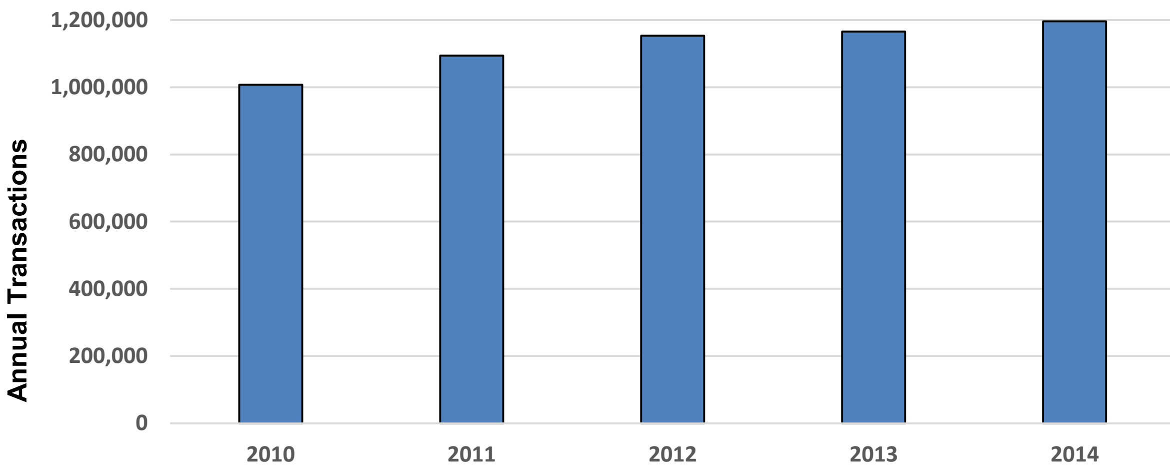
Automobile Access

Private automobile access to the Airport is classified as either curbside drop-off or parked on-Airport (terminal area or remote/Economy). Traffic conditions associated with these trips are described in this chapter's section on traffic conditions.

Rental Car

At the opening of the RCC in 2013, nine rental car brands were serving Logan Airport: Advantage, Alamo, Avis, Budget, Dollar, Enterprise, Hertz, National, and Thrifty. Payless and Firefly initiated operations in 2014 and Zipcar began operations at Logan Airport at the end of 2013. Rental car transactions (see Figure 5-10) have been increasing in recent years, following the trend of air passenger activity.

Figure 5-10 Annual Rental Car Transactions at Logan Airport, 2010-2014



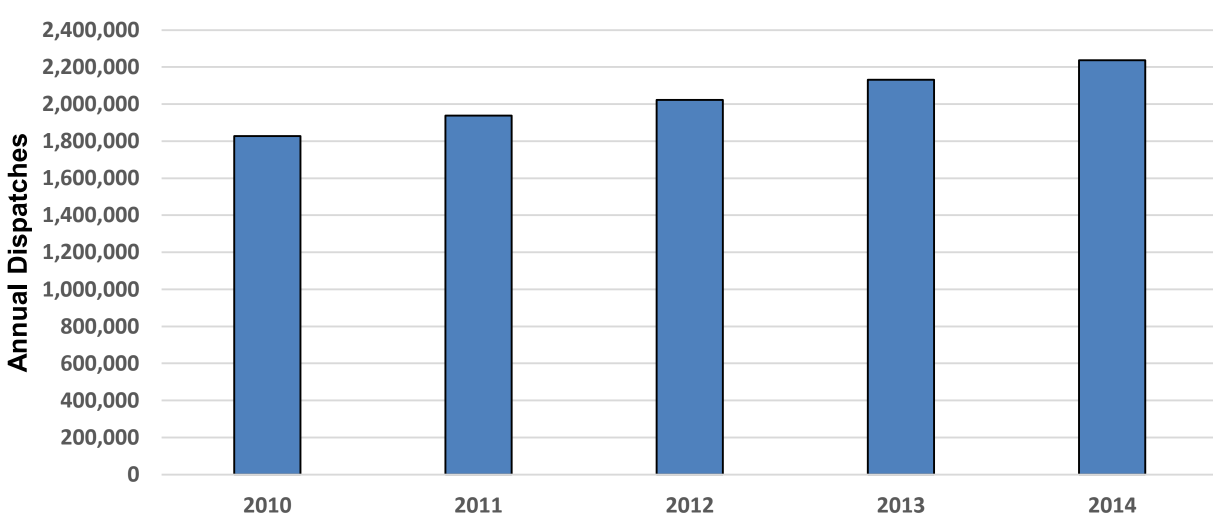
Source: Massport

Taxis

Taxi ridership trends are reflected in the total number of taxis dispatched from Logan Airport (serving outbound passengers). The number of taxis dispatched rose in 2014 by 5 percent over the 2013 level (Figure 5-11). However, in 2014, there were approximately 342 hours (experienced on 187 days) during which Logan Airport had a shortage of cabs and had to resort to multiple passenger/party loading at the curbs.

Taxi dispatches reflect the increase in air passenger levels. Taxi use in 2014 almost reached the highest recorded level at Logan Airport (2.14 million dispatches in 2000 when Logan Airport served 27.7 million annual air passengers).

Figure 5-11 Annual Taxi Dispatches at Logan Airport, 2009-2014



Source: Massport

Green Cab Program

Since 2007, Massport has sponsored a "Head-of-Line" hybrid vehicle taxi incentive program, in partnership with the City of Boston. Under this program Boston taxis that qualify as clean-fuel vehicles may obtain permission to proceed to the short job lane at Logan Airport's taxi pool; this allows these "green cabs" to be dispatched to the terminals in a shorter amount of time.

Ground Access Planning Considerations

Surface transportation modes have environmental impacts, and are considered a standard component of airport GHG emissions inventories (see *Chapter 7, Air Quality/ Emissions Reduction*). Enhancing multimodal transportation options is one way an airport can reduce GHG emissions and improve its environmental footprint.

Potential emissions reductions are one reason why Massport is committed to a long-term goal to promote and support public and private HOV/shared-ride services aimed at serving air passengers, Airport users, and employees. Other benefits include:

- Reducing congestion on the terminal roadways and curbside pick-up/drop-off areas;
- Alleviating limited parking facilities; and
- Customer service (providing a range of transportation options for different traveler markets).

Passenger HOV Mode Share Goal

Massport's current ground access goal is to attain a 35.2-percent passenger HOV mode share when annual air passenger levels reach 37.5 million. The 35.2-percent HOV mode share figure was developed by a planning process involving Massport staff and was first presented in the Logan Growth and Impact Control (LOGIC) planning studies that were completed in the early 1990s.[13] In subsequent environmental documents, the 35.2-percent HOV mode share became a declared goal related to ground access to Logan Airport.[14]

Progress toward this goal is measured using the triennial air passenger ground-access survey. The latest survey, which was conducted in 2013, revealed an air passenger ground-access mode share of 28 percent for HOV/shared-ride modes, which is a share consistent with past surveys. Historically, there has not been a significant shift in HOV mode share since 2004. This result demonstrates that Logan Airport has been able to maintain its HOV mode share in concert with improvements to roadway access to the Airport and despite increases in air passenger levels. Also, the result confirms Logan Airport's rank at the top of U.S. airports with respect to HOV/shared-ride mode share.[15] The next survey is scheduled to be completed in spring 2016.

Although generally useful, the calculation of overall HOV mode share is limited in that some modes can operate as both high occupancy and low occupancy vehicles (Table 5-10). Many automobile modes carry

13 *Logan Growth & Impact Control Study (LOGIC) Phase I Report* (1990) and *Logan Growth & Impact Control Study (LOGIC), Phase II Final Report* (June 1993).
14 *West Garage Final EIR* (January 31, 1995) and 1994 & 1995 *Annual Update of the Final Generic Environmental Impact Report (GEIR), vol. 1* (July 1996), which presents for the first time "Massport's Ground Access Management Plan" and states that its goals are "to achieve a 35 percent high-occupancy vehicle (HOV) mode share by air passengers…" [p. I-7-4]
15 It is useful to note that there is no standard aviation industry definition with respect to categorizing ground access modes as HOV versus SOV. While some modes (e.g., Logan Express and the Silver Line) clearly fall into the HOV mode category, the appropriate category for a limousine or taxi is less clear.

multiple passengers; for example, as seen in Table 5-10, the 2013 air passenger survey results indicate an average occupancy of 2.0 air passengers per private vehicle used for airport ground access.

Table 5-10 Average Vehicle Occupancy by Vehicular Ground Access Mode (2013)

Mode	Vehicle Occupancy	% SOV Trips
Private Vehicle	2.0	24%
Taxicab	1.8	28%
Rental Vehicle	1.6	37%
Subtotal for Automobile Modes	**1.9**	**28%**
Car Service ("black car" limousine by reservation)	1.9	30%
Courtesy Shuttle	3.6	7%
Shared-Ride Van or Limousine (scheduled or reservation)	4.4	7%

Source: Massport, 2013 Logan Airport Air Passenger Ground-Access Survey. Based on air passengers departing on both weekdays and weekend days.
Notes: The true average occupancy per vehicle arriving at the Airport cannot be computed from the responses to the survey because it is not possible to identify multiple travel parties arriving in a single vehicle. Average occupancy in this table was calculated as the average occupancy of arriving vehicles across survey respondents.
An SOV (single occupancy vehicle) passenger is defined as an air passenger that arrives at the Airport with no other air passengers in the vehicle. Air passengers can arrive as the only traveling air passenger in any of the above modes; thus, drivers and/or occupants who are not traveling are excluded from the occupancy calculation.

Through the strategic planning process, Massport has concluded that its overarching ground access goal must be to minimize the number of motor vehicles used by both passengers and employees traveling to and from Logan Airport. Achieving this goal will require balancing the need to accomplish three objectives:

- Maximizing the availability and use of transit, HOV, and shared-ride options for Logan Airport passengers and employees;
- Minimizing the number of pick-up/drop-off trips, particularly "dead head" trips in which a vehicle brings a passenger to Logan Airport and leaves with only the driver, effectively doubling the number of vehicle trips needed for that passenger to get to and from the Airport; and
- Managing parking supply, pricing, and operations to promote use of transit/HOV/shared-ride options and reduce the amount of diversions/valeting, all without increasing the number of pick-up/drop-off trips due to a constrained parking supply.

Massport is investigating alternative methods to describe the mode use and travel patterns of air passengers using Logan Airport to better reflect these considerations and track progress toward meeting all of its ground access goals, including, but not limited to, maintaining its high HOV mode share.

Conditions Under Constrained Parking

According to research conducted for Massport, Logan Airport is the only airport in the country with a parking freeze.[16] As described earlier in this chapter, during many weeks in 2014, vehicles were periodically diverted from Central Parking to Economy Parking or Terminal E lots, or valeted to other areas until lined spaces became available. Peak-day demand is not showing signs of dampening, and overflow conditions

16 LeighFisher, August 2011.

persist. These conditions exist despite the supply of over 2,700 parking spaces off-Airport at nearby private lots, and despite the increases in Logan Express use since the lowering of its parking rates.

With the Logan Airport Parking Freeze (and current capacity levels) in place, weekday demand is outpacing supply on a regular basis. Under such conditions, travelers arriving at the Airport to park on Tuesdays and Wednesdays would find themselves unable to park their cars on-Airport.

In March 2014, Massport reconfirmed with the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) that providing additional structured parking spaces up to the total allowed by the Parking Freeze does not require further environmental review.[17] Thus, construction of the West Garage expansion began in 2014 and will consolidate new structured and existing surface parking facilities. This project will establish defined physical striped spaces for vehicles that would come to Logan Airport with or without the construction of the spaces. In other words, spaces in these areas will help to reduce overflow conditions and the need for vehicle diversions on peak- parking-demand days.

Planning for Passenger Ground Access

In the past, the ground access strategy has operated within the constraints of the Logan Airport Parking Freeze. Future efforts will need to better address the growing use of pick-up/drop-off modes that include private vehicles, taxis, limousine, and alternative taxi modes. Pick-up/drop-off vehicle activity is growing in response to the constrained parking supply.

Regularly conducted passenger surveys have shown that under constrained parking conditions, three-quarters of "would be" parkers opt for "pick-up/drop-off" modes rather than HOV/shared-ride modes. Accordingly, an unintended effect of constrained parking supply has been an increase in the total number of vehicle trips generated by Logan Airport passengers.

Therefore, the challenge is how to influence a mode shift so that the passengers generating the excess parking demand are encouraged to use sustainable transportation modes (including public transit, Logan Express, and other shared-ride services) rather than increase taxi and private vehicle drop-off and pick-up activity that would generate increased levels of traffic and curbside congestion (and associated emissions) at Logan Airport. As passenger levels have increased, the lack of commercial parking spaces has had the counterproductive effect of inducing more pick-up/drop-off travel which entails more trips, VMTs, and air emissions than trips by people who park at the Airport. This is a key planning issue that Massport will address in future Airport-wide planning efforts. Massport's longer-range ground access strategy will balance the need to maximize the HOV/transit/shared-ride mode share, manage on-Airport parking, and reduce pick-up/drop-off vehicle trips.

Ground Access Initiatives

Massport promotes ridership on HOV/transit/shared-ride modes and maintains efficient transportation access and parking options in and around Logan Airport to reduce the reliance on automobile modes as a means to achieving the HOV mode share goal. Measures implemented by Massport include a blend of strategies related to pricing (incentives and disincentives), service availability, service quality, marketing,

17 MEPA Advisory Opinion letter, March 20, 2014.

and traveler information. Because of the diverse market segments of the air passenger traveler, no single measure will accomplish the goal.

HOV/Transit/Shared-Ride Initiatives

In April 2014, Massport initiated the Back Bay Logan Express service. Using Massport's 42-foot CNG buses, this service provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square (at the MBTA's Green Line Station), and Logan Airport. Aside from serving an area that generates a significant number of trips to the Airport, the service serves transit riders inconvenienced by the two-year closure of Government Center station, where the Green Line meets the Blue Line.

Massport has expanded its Logan Express bus service, including spending $30 million to build a 1,100-space parking garage in Framingham to meet growing passenger and employee demand. The Framingham Logan Express carries the highest number of non-employee passengers of all the Logan Express services. This new facility opened in early 2015 and will be discussed further in the *2015 EDR*.

Parking Programs and Initiatives

Cell Phone Waiting Lot

The cell phone waiting lot in the vicinity of Terminal E provides 61 parking spaces where drivers waiting for passengers on arriving flights may park. Before the creation of the Cell Phone Waiting Lot, drivers who were waiting for arriving passengers either used the short-term parking, circulated around the Airport, or dwelled at the curb until asked to move by State Police officers. This facility reduces vehicle emissions by minimizing idling and on-Airport VMT by such motorists. The maximum wait time permitted at this parking lot is 30 minutes and parking is free of charge.

PASSport Gold and Parking PASSport

Parking PASSport Gold and Parking PASSport allow users to enter and exit Logan Airport's parking garages and lots with an access card that is linked to an established account for faster payment transactions. Parking fees are automatically charged to a registered credit card and the receipt is emailed to the account holder. Customers in the Parking PASSport programs account for approximately 3 to 4 percent of parking exits at Logan Airport.

Massport offers guaranteed parking through its Parking PASSport Gold program. Parking PASSport Gold eliminates the need for a motorist to circle the garage looking for available spaces. First implemented in 2006, the Parking PASSport Gold program had 9,011 customers as of December 31, 2014, compared to 7,544 at the end of 2013. About 8 percent of spaces in the Central/West Parking garage and 12 percent of spaces in the Terminal B garage are set aside for these customers.

Hybrid/Alternative Fuel Vehicle Preferred Parking

In the State's first preferred parking program for hybrid and alternative fuel vehicles (AFVs), Massport began offering preferred parking for customers driving hybrid and AFVs in the spring of 2007. Massport provides designated parking spaces at Logan Airport's Central Garage, Terminal B Garage, Terminal E surface lot, and Economy Parking.

Employee Ground Transportation Initiatives

Airport employee transportation has different ground access considerations than passenger transportation. Airport employees often have non-traditional (and often unpredictable) working hours that are difficult to match to typical transit service hours (MBTA service does not start until after 5:00 AM and ends by 1:00 AM). Due to the time-sensitive nature of airline operations, on-time reliability is important for employee transportation, as is flexibility during severe weather or other delays that may extend a typical employee workday or work shift.

Massport strives to reduce the number of Airport employees commuting by private automobile, to enhance commuter options, and to reduce traffic and parking demands at Logan Airport. To help accomplish these objectives Massport continues to:

- Provide off-Airport employee parking in Chelsea, which is served by frequent shuttle bus service to the terminals (Route 77) 24 hours a day, 7 days a week;
- Run free employee shuttle buses between Airport Station and employment areas in the SWSA and the SCA locations (Routes 44, 66, and Logan Office Center);
- Operate early morning and late night Logan Express bus trips for commuters.
- Support the Logan Transportation Management Association (TMA);
- Support the Sunrise Shuttle for early morning bus service from East Boston prior to the start of MBTA service;
- Create and maintain a comprehensive sidewalk/walkway system on Logan Airport to facilitate pedestrian access; and
- Provide bicycle racks.[18]

Two of these initiatives that are exclusively targeted to employees are described below.

Logan Transportation Management Association (TMA)

The Logan TMA advises Airport employers on transit benefits and provides information on available commuting transportation alternatives, ride-matching services, and reduced-rate HOV/transit fare options. Massport contributes $65,000 annually to the Logan TMA. Benefits and services provided by the Logan TMA in 2014 included:

- East Boston early morning shuttle service (Sunrise Shuttle) (further details are provided below);
- Computerized ride-matching services for participating in carpools and vanpools; and
- Advocacy for improved service and reduced fares for its members from Massport, the MBTA, or other providers of mass transit and other alternative forms of transportation.

18 Bicycle racks are provided at Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage (covered), Signature general aviation terminal, the Green Bus Depot (Bus Maintenance Facility), and the Rental Car Center (covered).

Sunrise Shuttle

Originally launched in August 2007, this shuttle service provides low-cost transportation to Airport employees who live in nearby East Boston and Winthrop. A second shuttle route was added in October 2011 that serves East Boston's Orient Heights neighborhood and Winthrop.

The Sunrise Shuttle services operate outside of MBTA service hours between 3:00 AM and 6:00 AM, with shuttles every half-hour transporting employees to the Airport terminals. Ridership levels have steadily increased since the shuttle's launch. The two-route service has reached over 1,000 riders per month.

Ground Access Goals

Table 5-11 lists each ground access goal and updates Massport's initiatives associated with each goal. Initiatives are planned, designed, implemented, and continuously refined to account for the changing national, regional, and local conditions that affect Logan Airport and its users.

Table 5-11 Ground Access Planning Goals and Progress (2014)

Goal	2014 Update
Increase air passenger ground access (high-occupancy vehicle) HOV mode share to 35.2 percent by the time Logan Airport accommodates 37.5 million annual air passengers	The *2013 Logan Airport Air Passenger Ground Access Survey* revealed that 28 percent of air passengers use HOV/shared-ride modes to access the Airport. Massport continues to provide and actively promote numerous HOV/shared-ride options to air passengers, including Logan Express bus service, the Silver Line, water shuttle service, and frequent, free shuttle bus service to and from the Massachusetts Bay Transportation Authority (MBTA) Blue Line rapid transit Airport Station. Massport is investigating ways to increase HOV mode share by implementing new HOV initiatives and pricing strategies. Massport continues its partnership with the MBTA to offer free boardings of the Silver Line bus at the Airport. The promising results of reduced dwell times and faster travel times through the terminal area led Massport to extend the free-fare program indefinitely. Next-bus arrival digital dynamic signs have been added to the Terminal curb bus stops to now include Airport Shuttle, Blue Line/Rental Car, and Logan Express (in addition to Silver Line previously installed). Massport continues to improve wayfinding for ground transportation (with an emphasis on public transportation) within the terminals, resulting in enhanced directional signs in the terminals for arriving air passengers. In April 2014, the Boston Back Bay Logan Express service was implemented.
Reduce employee reliance on commuting alone by private automobile	Massport continues to support the Logan Transportation Management Association (TMA) with $65,000 annually (no dues are collected from Airport employers). Massport uses funds from the Logan TMA to operate the two early morning Sunrise Shuttle services that operate in East Boston and Winthrop. For employees who reside in neighborhoods and communities closer to the Airport, bicycle parking options have increased with bicycle racks offered at Terminals A and E, the Economy Garage, the Green Bus Depot, the Rental Car Center, the Logan Office Center, and the Signature general aviation terminal. Massport is also investigating ways to improve bicycle access to/around Logan Airport facilities. For example, the East Boston Greenway Connector construction was completed in July 2014.

Table 5-11 Ground Access Planning Goals and Progress (Continued)

Goal	2014 Update
Increase the overall efficiency of the metropolitan transportation system through interagency coordination	Massport participates in the Metropolitan Planning Organization (MPO) to promote planning and funding of transportation system options that enhance access to the Airport. Massport and the MBTA have worked together on several initiatives including the renovated Blue Line Airport Station and the Silver Line SL1 service to Logan Airport. Massport has also partnered with the MBTA, MassDOT, the City of Boston, and the Convention Center Authority in developing transportation improvement plans for the South Boston Waterfront, including alternatives that would improve Silver Line access between South Station, the South Boston Waterfront, and the Airport.
Improve management of on-Airport ground access and infrastructure through technology	Massport disseminates ground access and parking information through the Internet (www.massport.com), social media (Twitter and Facebook), a toll-free telephone number (1-800-23-LOGAN), Smartraveler, and in-Airport kiosks. Massport's redesigned website has an interactive tool that helps users access Logan Airport, while providing multimodal options.[19] In 2014, Logan Airport continued to experience peak levels of parking demand for the terminal area parking garages. In an effort to reduce the operational impacts of peak parking, Massport began the expansion of the West Garage in 2014. The total number of parking spaces at the Airport remains within the Logan Airport Parking Freeze limits.

19 Massport, GetUthereApp, www.massport.com/massport/gtu/Pages/default.aspx.

6

Noise Abatement

Introduction

The Massachusetts Port Authority (Massport) strives to minimize the noise effects of Logan Airport operations on its neighbors through a variety of noise abatement programs, procedures, and other tools. Logan Airport has one of the most extensive noise abatement programs of any airport in the nation. Massport's comprehensive noise abatement program includes a dedicated Noise Abatement Office, residential and school sound insulation programs; flight tracks designed to optimize over-water operations (especially during nighttime hours); and preferential runway use goals. The foundation of Massport's program is the *Logan Airport Noise Abatement Rules and Regulations*[1] (the Noise Rules), which have been in effect since 1986. Massport's Noise Abatement Office is responsible for implementing noise abatement measures and generally monitoring community complaints and other aspects of the noise effects from Logan Airport operations. The chapter describes predicted noise conditions at Logan Airport related to aircraft operations during 2014 and compares the findings to those for 2013. Historical comparisons are also made to the year 1990 and 2000.

Noise conditions for 2014 were assessed primarily through computer modeling, supplemented by the analysis of measured noise levels from Logan Airport's noise monitoring system. This chapter presents summaries of the operational data used in the noise modeling, as well as the resultant annual Day-Night Average Sound Level (DNL) noise contours, a comparison of the modeled results with measured levels from the noise monitoring system, and estimates of the population residing within various increments of noise exposure. Analyses also include a number of supplemental noise metrics including Logan Airport's Cumulative Noise Index (CNI) and reporting on the Time Above (TA) various threshold sound levels and periods of dwell and persistence of noise levels. Massport's progress on implementing noise abatement measures also is presented.

Appendix H, Noise Abatement provides historical details back to 1990 of operations, runway use, the sound insulation program, and noise exposed population. The appendix also contains the *Flight Track Monitoring Report* for 2014 and a *Fundamentals of Acoustics and Environmental Noise* section, which gives an overview of key noise issues, noise metric definition, and terminology for the general reader.

1 The *Logan International Airport Noise Abatement Rules and Regulations*, effective July 1, 1986, are codified as 740 Code of Massachusetts Regulations (CMR) 24.01 et seq (also known as the Noise Rules).

2014 Noise Abatement Highlights and Key Findings

Since 2000, the number of daily aircraft operations has declined by almost 27 percent (from 1,355 operations per day in 2000 to 997 operations per day in 2014). This trend reflects an increase in the use of larger aircraft in the fleet, airline consolidation, and increased efficiencies on the part of airlines. As described throughout this EDR, this evolution towards fewer flights with larger, more efficient and quieter aircraft has yielded substantial environmental benefits. Compared to 2000, in 2014:

- Jet operations made up 86 percent of operations compared to 66 percent in 2000;
- Overall operations were down by 25 percent while overall passengers were up by 14 percent compared to 2000; and
- The number of people exposed to sounds levels of DNL 65 dB or higher has declined by 50 percent since 2000.

Operations and Fleet Mix

- Passenger volumes continue to increase at a higher rate than aircraft operations. Aircraft operations in 2014 increased 0.7 percent while passenger volumes increased by 4.7 percent compared to 2013.
- General Aviation (GA) operations in 2014 (26,416) remain well below the 35,233 GA operations that Logan Airport handled in 2000. GA operations decreased 1.0 percent from 2013 to 2014. GA operations continue to represent only a small percentage (7.3 percent in 2014) of total Logan Airport operations.
- Over 97 percent of all commercial jet operations at Logan Airport met the strictest Stage 4 international noise limits. One hundred percent of all commercial jet operations now meet Stage 3 noise standards. None of the older aircraft that were modified to meet Stage 3 noise recertification requirements remain in Logan Airport's commercial fleet.
- In 2014, for the first time, there were no Stage 2 jet operations (less than 75,000 pounds) operating at Logan Airport. This is a significant milestone on the FAA's phase out of older, noisier civil aircraft.
- There were several temporary FAA-mandated airfield/airspace operating factors that influence contour changes in 2014, including:
  - Due to safety concerns, at airports across the United States in June of 2014, the FAA temporarily halted the use of head-to-head operations[2], or opposite direction operations, in which planes arrive on a runway in one direction and depart in the opposite direction. When in use at Logan Airport, the procedure has aircraft departing from Runway 15R and landing on Runway 33L during the late night (typically midnight to 5:00 AM) when weather conditions are appropriate, including good visibility and little wind. At Logan Airport, head-to-head operations are an important part of the use of the late night noise abatement runway (Runway 15R-33L) since this keeps operations over Boston Harbor. Use of this procedure was restored in early 2015.
  - FAA also restricted the use of converging runways across the United States in January 2014 due to safety concerns. At Logan Airport, Runways 22L and 22R and Runway 27 were affected by this change. While Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 were sent by the FAA Air Traffic Control to arrive on Runway 22L. This restriction has since been lifted.

2 Head-to-head operations, or opposite direction operations occur when aircraft depart from a runway end and aircraft are cleared to land to the opposite end of that runway. This results in aircraft overflights off only one end of the runway and is typically used as a noise abatement procedure when traffic levels are light.

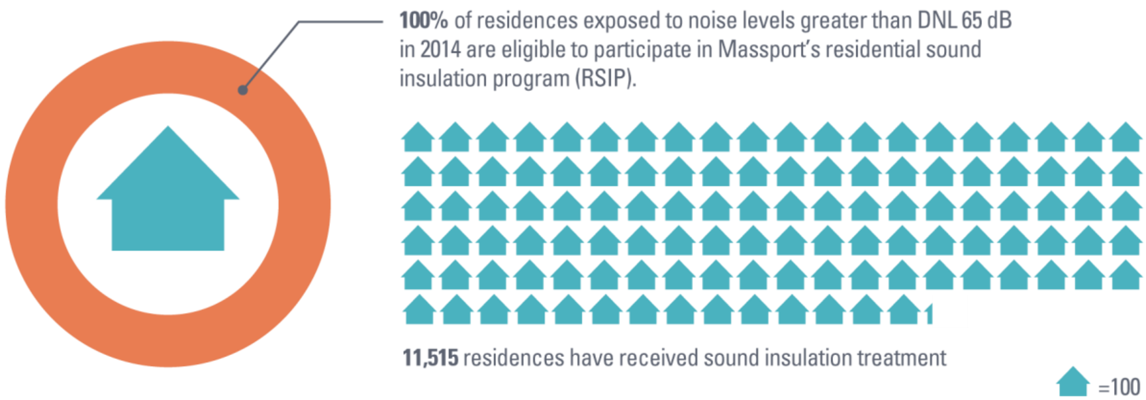
- Runway 15L-33R was closed for a short period of time (eight weeks) during the summer of 2014 for Runway Safety Area Improvements. This resulted in aircraft using Runway 15R-33L, Runway 4L, and Runway 22L more frequently in 2014 than in 2013. The construction activity also resulted in short closures of the intersecting Runway 4L-22R and Runway 4R-22L which increased usage of Runway 5R- 33L.

- An additional factor influencing contour changes was an increase in overall operations and nighttime operations in 2014 compared to 2013. Nighttime operations increased for passenger flights as airlines expanded destinations and the number of flights per day. Several new international airlines began service at Logan Airport in 2014.

Noise Levels and Population

- The 2014 contours are significantly smaller than the 2000 contours in most areas and are similar in size over the Eagle Hill area of East Boston. This is the result of quieter engines and fewer flights. Compared to 2013, the 2014 DNL 65 dB noise contours were larger in most areas around the Airport. Noise contour changes specific to 2014 in comparison to 2013 are discussed below.

- The DNL and population levels in 2014 remain well below the peak levels reached in 1990 and 2000. The 2014 population counts are below year 2000 levels when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB. However, due to the combination of the factors described above, in 2014 the overall number of people exposed to DNL values greater than 65 dB increased from 4,307 people in 2013 to 8,922 people in 2014.[3] All of the residences exposed to levels greater than DNL 65 dB in 2014 have been eligible to participate in Massport's residential sound insulation program (RSIP).



- In 2014, an additional 106 residential units received sound insulation bringing the program total to 11,515 residential units treated. Massport is a national leader in sound insulation mitigation, and will continue to seek funding for sound insulation for properties that are eligible and whose owners have chosen to participate.

3 Population data were derived from the most recent 2010 United States Census.

- The 2014 CNI of 152.9 Effective Perceived Noise Decibels (EPNdB)[4] remained well below the cap of 156.5 EPNdB established under Massport's noise regulations.
- Massport responded to 12,855 noise complaints in 2014. All complaints were also forwarded to the FAA.

Airspace Reporting and Update

- The FAA's Record of Decision (ROD) approving construction of the unidirectional Runway 14-32 required that the FAA, Massport, and the Logan Airport Community Advisory Committee (CAC) jointly undertake a study to determine whether changes to existing noise abatement flight track corridors might further reduce noise impacts. The primary focus of the Boston Logan Airport Noise Study (BLANS) is to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency.[5] The aRea NAVigation (RNAV) departure portions of Phase 1 of the project, first implemented in 2010, continued to be utilized in 2014.
- Phase Three of BLANS is a test of a Runway Use Program which began in 2014 and will continue throughout 2015. Starting in November of 2014, the FAA selected runway use configurations in the morning (6:00 AM to 9:30 AM), when weather conditions permit, which are different from the configuration used the night before. This is designed to reduce the persistence of noise on residential communities.
- The 2014 Flight Track Monitoring reports in *Appendix H, Noise Abatement* show that 99 percent of shoreline crossings (locations where aircraft which have departed over the water pass back over land) are by aircraft above 6,000 feet, reflecting the same level as 2013. This is beneficial to communities under those flight paths.
- The percentage of aircraft following the Runway 27 departure procedure was at 77 percent for 2014 (an increase from 75 percent in 2013), which continued to remain in compliance with the Runway 27 ROD.[6] The FAA determined in early 2012 that no further evaluation of the Runway 27 departure flight corridor is needed.[7] Massport will continue to monitor and publish compliance with the procedure in the annual Flight Track Monitoring Report in this and subsequent Environmental Data Report (EDR)/Environmental Status and Planning Report (ESPR) filings.

Noise Metrics

The common metrics used in this chapter to describe and evaluate aircraft noise are:

- The dB – The decibel is the standard unit of measure for sound. It is a logarithmic quantity reflecting the ratio of the pressure of the sound source of interest and a reference pressure. This logarithmic conversion of sound pressure to sound pressure level results in a sound pressure level of about zero dB for the quietest sounds that one can detect and sound pressure levels of about 120 dB for the loudest sounds we can hear without pain. Many sounds in our daily environment have sound pressure levels on the order of 30 to 100 dB.
- The DNL – The Day-Night Average Sound Level is a measure of the cumulative noise exposure over a 24- hour day. It is the 24-hour, logarithmic (or energy) average; A-weighted sound pressure level with a 10

4 EPNdB is the metric used for Aircraft Noise Certification and forms the basis of the CNI.
5 For more information, visit the BLANS website at www.bostonoverflightnoisestudy.com/index.aspx.
6 FAA. Runway 27 Record of Decision. 1996.
7 FAA. Runway 27 Advisory Committee Meeting Notes 01/23/12, published March 5, 2012.

dB penalty applied to the nighttime event levels that occur between 10:00 PM and 7:00 AM. The DNL is the FAA-defined metric for evaluating noise and land use compatibility.

- TA – The Time Above metric describes the total number of minutes that instantaneous sound levels (usually from aircraft) are above a given threshold. For example, if 65 dB is the specified threshold, the metric would be referred to as "TA65." The TA metric is typically associated with a 24-hour annual average day but can be used to represent any time period. Any threshold may be chosen for the TA calculation. For this study, TA65, TA75, and TA85 were computed at each of the monitoring sites.
- Effective Perceived Noise Level (EPNL) – A time series of "tone corrected" perceived noise levels are used to compute EPNL, which is expressed in units of EPNdB. The tone corrected perceived noise level is determined by measuring the perceived noise level and adding to that value a "pure-tone" correction of up to 6 dB. The EPNdB is an international standard for the noise certification of aircraft and is used in this report in the calculation of the CNI.

Regulatory Framework

The noise regulatory framework that this *2014 EDR* follows is defined in *Appendix H, Noise Abatement.* Regulations discussed include:

- Logan Airport Noise Abatement Rules and Regulations
- Federal Aviation Regulation (FAR) Part 36
- FAR Part 150
- FAR Parts 91 and 161

Noise Modeling Process

The DNL, CNI, and TA noise metrics reported annually by Massport provide various means of understanding and comparing Logan Airport's complex noise environment from one year to the next. The noise context is influenced by numbers of operations, types of aircraft operating during the day and at night, use of various runway configurations, and the location and frequency of use of flight paths to and from the runways. Changes in any one of these operational parameters from one year to the next can cause changes in the values of the noise metrics and alter the shapes of the noise exposure contours that represent the accumulation of noise events during an average day.

Massport continues to make use of state-of-the-art improvements in the noise modeling process, which has been updated each year. These developments in noise modeling technologies and techniques, which were first employed in the preparation of the *2005 EDR*, and have continued through this *2014 EDR*, are discussed below.

- Continued use of the latest version update to the FAA's Integrated Noise Model (INM), while retaining the unique capability to account for over-water sound propagation and hill effects at Logan Airport. Massport's use of the latest FAA-approved version of the INM (INMv7.0d[8] to model the 2014 noise conditions) along with additional provisions approved by FAA to accommodate the Airport's unique water and terrain characteristics that have been shown through earlier technical studies to affect sound propagation into surrounding neighborhoods, has improved the modeling results. Logan Airport is the only airport in the world that incorporates these features into its approved modeling process.
- This *2014 EDR* is the sixth year Exelis data have been used for all aspects of the modeling process. The measured noise and the flight track data all come from the Massport Noise and Operations Management System (NOMS).
- The flight operations data from the NOMS includes more information with each flight record, such as aircraft registration numbers, wherever possible providing better INM aircraft type selection. This allows for the assignment of the modeled INM aircraft type based on the specific aircraft and engine combination used on each flight at Logan Airport during 2014.
- The modeling process includes continued use of U.S. Geological Survey (USGS) digital terrain data. INMv7.0d uses the detailed terrain data to evaluate each receptor location at its proper elevation, which enhances the accuracy of the results.
- Inputs to the modeling process include use of automated altitude profile and noise contour generation software. Massport purchased licenses to run two additional software packages, RealProfiles™ and RealContours™.[9] [10]
  - RealContours™ automates the production of noise contours directly from every individual radar trace. In 2014, approximately 355,451 traces were collected and 345,090 retained enough information to be modeled in the RealContours™ system. Each radar trace was converted to an INM model track, ensuring that the lateral dispersion of radar tracks was retained in the modeling. The operations on these radar traces were then scaled to account for all of the 363,797 operations in 2014. This method also helps to develop more accurate noise contours by retaining the actual runway used and time of each operation.
  - RealProfiles™ analyzes each radar trace and automatically produces custom aircraft performance profiles using the INM aircraft database. The INM typically uses pre-defined profiles to "fly" each aircraft along the ground track. The custom profiles are designed to follow the actual flight of each aircraft allowing the INM to model each flight at its actual location on the ground and in the sky. For 2014, 320,417 flight tracks (92.8 percent) used these specially designed profiles of which 166,842 (98.7 percent) of the available departure profiles and 153,575 (87.3 percent) of the available arrival profiles were developed from the actual radar data.
- Accurate altitude modeling, using the aircraft performance profiles developed by RealProfiles™ from the radar data, enhances the modeled noise results at each of the monitoring sites.

8 INM Version 7.0d was released in May 2013 with a technical update in Sept 2013.
9 RealProfiles™ and RealContours™ are methods to provide more accurate inputs to the INM but do not change or modify the algorithms of the FAA-required INM.
10 The *2004 ESPR* included a comparative analysis of the results of the standard INM modeling approach with RealProfiles™ and RealContours™.

- This software incorporates the FAA-approved INM as the computational engine for calculating noise, but provides greater detail through the uses of individual flight tracks taken directly from radar systems rather than relying on consolidated, representative flight tracks data.

RealContours™ improves the precision of modeling by:

- Directly converting the radar flight track for every identified aircraft operation to an INM track, rather than assigning all operations to a limited number of prototypical or representative tracks;
- Modeling each operation for the actual time of day and on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types;
- Selecting the specific airframe and engine combination to model, on an operation-by-operation basis, based on the aircrafts registration or a published composition of the fleets of the specific airlines operating at Logan Airport; and
- Using each aircraft's actual performance and altitude profile to develop inputs to the model, which define the actual arrival, or departure profile.

RealContours™ uses INM to produce computations for each day of radar data and then compiles annual average noise exposure contours and supplemental metrics from each of the 365 days of computations. All of these enhancements are examples of Massport's continued commitment to improving the monitoring, reporting, and understanding the noise environment at Logan Airport. The following section of this chapter summarizes the basic operational data used to compute the DNL, CNI, and TA noise metrics reported for 2014.

Noise Model Inputs

For this *2014 EDR*, the most recent available version of the FAA's INM was used (version INM 7.0d). The FAA's INMv7.0d was released for general use on May 23, 2013 with a Software Service Update on September 24, 2013. The latest version was used for the 2013 and 2014 DNL contour in this report as the primary analytical tool to assess the noise environment at Logan Airport. Several new air carrier jets were added to the model replacing substitutes used in the prior version of the INM model. The Boeing 787-8, 747-800 and 777-300ER were added along with the Embraer family of aircraft. Further details on the enhancements of INMv7.0d are included in *Appendix H, Noise Abatement*.

The INM requires detailed operational data as inputs for its noise calculations, including numbers of operations per day by aircraft type and by time of day, which runway for each arrival and for each departure, and flight track geometry for each track. These data are summarized in tables that follow or are included in *Appendix H, Noise Abatement.* The following section summarizes the average-day operations for each year, 2014, as used in the noise modeling and compares them to the previous year's data.

The FAA has released a new model that will replace the INM called the Aviation Environmental Design Tool (AEDT). This model was released on May 29, 2015 well after development of the 2014 DNL contours was complete. The new model combines the noise and air quality modeling into one modeling system. Massport plans to use the AEDT system to develop 2015 noise contours which will be documented in the next EDR along with comparisons to the legacy INM model. Massport is also committed to working with the FAA to continue the use of the airport specific adjustments to the AEDT noise model for Logan Airport.

Fleet Mix

Since 2004, Massport has relied primarily on radar data as the main source of input for noise calculations, since radar data typically are more accurate than the information reported by air carriers. The radar data result in a list of approximately 500 different aircraft types that use Logan Airport during a year, including the wide variety of small corporate jets and propeller aircraft flown by GA users, as well as the large passenger and cargo jets operated by air carriers.

For 2014, the aircraft types identified by the radar data were matched to the INMv7.0d database, which contains individual noise and performance profiles for 279 different fixed-wing aircraft types, 164 of which represent civilian aircraft, the balance being military aircraft.[11] For those aircraft recorded in radar data that are not in the INM's database, the radar type is paired with the best available alternative using a standard FAA-approved substitution list. The final list of modeled aircraft, used as an input to the INM, is presented in detail in *Appendix H, Noise Abatement*.

Operations by aircraft type are summarized into several key categories: commercial (passenger and cargo) operations; Stage 2 or Stage 3 jet aircraft; and turboprop and propeller (non-jet) aircraft. Aircraft that meet Stage 4 jet requirements are also broken out from the Stage 3 jet aircraft data for 2014. These Stage 4 aircraft are defined as aircraft certified as Stage 4 and all Stage 3 aircraft, which, if recertified, would qualify as Stage 4 aircraft. FAA does not require aircraft to be recertified and there are no plans at this time to restrict Stage 3 operations. In addition, the operations are split into daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM, consistent with the definition of DNL. Table 6-1 summarizes the numbers of operations by categories of aircraft operating at Logan Airport in 2014 and includes similar data for 2011 and prior years back to 2000. Data prior to 2000 are included in *Appendix H, Noise Abatement*.

11 Some of these are military types as well as older Stage 1 and 2 airplanes that no longer operate in the U.S. or do not operate at Logan Airport. There are ordinarily no military aircraft operations at Logan Airport.

Table 6-1 Modeled Average Daily Operations by Commercial and General Aviation Aircraft[1]

		1990[3]	2000[3]	2010[2]	2011[2]	2012[2]	2013[2]	2014[2]
Commercial Aircraft (Passenger and Cargo)								
Stage 2 Jets[4]	Day	312.40	5.13	0.01	0.01	0.01	0.01	0.00
	Night[5]	19.99	0.26	0.01	0.00	0.00	0.00	0.00
	Total	**332.39**	**5.39**	**0.02**	**0.01**	**0.01**	**0.01**	**0.00**
Stage 3 Jets (All)	Day	288.89	727.09	674.25	684.19	649.22	667.65	670.00
	Night	57.25	103.66	107.92	109.38	106.55	115.91	123.60
	Total	**346.14**	**830.75**	**782.17**	**793.57**	**755.77**	**783.56**	**793.61**
Air Carrier Jets	Day	NA[6]	648.95	521.64	540.75	530.76	546.27	556.59
	Night	NA[6]	99.79	93.98	96.24	98.68	107.17	115.84
	Total	**NA[6]**	**748.74**	**615.62**	**636.99**	**629.44**	**653.44**	**672.43**
Regional Jets	Day	NA[6]	78.14	152.61	143.44	118.46	121.38	113.41
	Night	NA[6]	3.87	13.94	13.14	7.87	8.74	7.77
	Total	**NA[6]**	**82.01**	**166.55**	**156.58**	**126.33**	**130.12**	**121.18**
Non-Jet Aircraft	Day	444.41	409.62	138.53	135.18	133.92	132.33	128.45
	Night	11.72	21.58	5.21	4.73	3.06	3.21	2.28
	Total	**456.13**	**431.20**	**143.74**	**139.91**	**136.98**	**135.54**	**130.73**
Total Commercial Operations	Day	1,045.70	1141.84	812.78	819.39	783.14	799.99	798.45
	Night	88.96	125.51	113.13	114.11	109.62	119.12	125.88
	Total	**1,134.66**	**1267.35**	**925.91**	**933.50**	**892.76**	**919.12**	**924.33**
GA Aircraft								
Stage 2 Jets[4]	Day	NA[7]	7.29	0.27	0.08	0.25	0.31	0.00
	Night	NA[7]	0.64	0.04	0.00	0.04	0.02	0.00
	Total	**NA[7]**	**7.93**	**0.30**	**0.08**	**0.29**	**0.33**	**0.00**
Stage 3 Jets	Day	NA[7]	40.08	27.80	52.51	52.93	51.21	52.64
	Night	NA[7]	3.21	3.21	5.35	7.20	5.10	4.65
	Total	**NA[7]**	**43.29**	**31.01**	**57.87**	**60.13**	**56.31**	**57.29**
Non-Jets	Day	NA[7]	34.57	8.19	18.18	15.16	13.06	13.95
	Night	NA[7]	1.83	0.72	1.29	1.29	1.15	1.13
	Total	**NA[7]**	**36.40**	**8.92**	**19.48**	**16.45**	**14.22**	**15.08**
Total GA Operations	Day	NA[7]	81.94	36.26	70.78	68.35	64.58	66.59
	Night	NA[7]	5.68	3.97	6.65	8.52	6.28	5.78
	Total	**NA[7]**	**87.62**	**40.22**	**77.43**	**76.86**	**70.85**	**72.37**
Total	Day	1045.70	1,223.78	849.03	890.16	851.49	864.57	865.05
	Night	88.96	131.19	117.10	120.76	118.13	125.40	131.66
	Total[3]	**1,134.66**	**1,354.97**	**966.13**	**1,010.92**	**969.61**	**989.97**	**996.70**

Source: Massport's Noise Monitoring System, Revenue Office, HMMH 2014.
1 Operations include scheduled and unscheduled operations. Data for years prior to 2010 are available in *Appendix H, Noise Abatement*.
2 After 2009, the split between air carrier jets and regional jets (RJs) is 90 seats with RJs having less than 90 seats.
3 Prior to 2010, the split between air carrier jets and RJs is 100 seats with RJs having less than 100 seats.
4 Stage 2 aircraft are exempt from meeting newer federal Stage 3 noise limits when their certificated maximum gross takeoff weight (MGTOW) is less than or equal to 75,000 pounds through 12/31/2015.
5 Nighttime operations occur between 10:00 PM and 7:00 AM.
6 RJs were not tracked separately prior to 1999.
7 Totals prior to 1998 do not include GA operations.

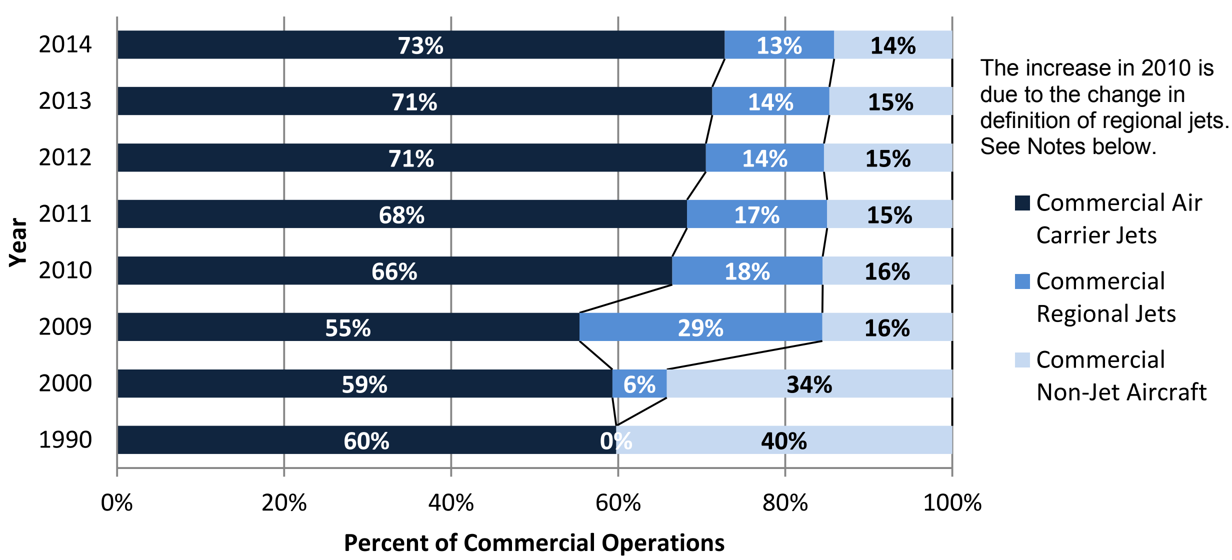
Commercial Operations

Regional jets (RJ) are defined as those aircraft with 90 or fewer seats, consistent with the categorization in *Chapter 2, Activity Levels*.[12] For years prior to 2010, the RJs in this chapter were classified as aircraft with fewer than 100 seats. When RJs first started gaining popularity, the aircraft types available were typically 50 seats or fewer with the traditional air carrier jet being 100 seats and higher. As newer aircraft types have become available, the smaller 35 to 50 seat types have been replaced by 70 to 99-seat types, with the 90 and above seat types flying many of the traditional air carrier routes. The majority of the newer types fall into two categories: the 70 to 75-seat category, which remain categorized as RJs, and the 91 to 99-seat category, which are categorized as air carrier jets.

The percent of RJs and Non-Jets in the overall commercial fleet each fell 1 percent between 2013 and 2014 (Figure 6-1). These decreases were offset by a 2.0 percent increase in commercial air carrier jet operations, which accounted for 73 percent of commercial operations in 2014 compared to 71 percent in 2013.

Figure 6-1 presents the commercial operations groups in terms of percent of the total for each year from 2009 through 2014 and including 1990 and 2000 for historical context. Figure 6-1 also shows the decrease in commercial non-jet operations after 2000 (34 percent of the fleet) and the rise of RJs, which were just 6.0 percent of the fleet in 2000 and increased to almost 30 percent of the fleet by 2009.

Figure 6-1 Fleet Mix of Commercial Operations (Passenger and Cargo) at Logan Airport



Source: HMMH, 2014.
Notes: Includes both passenger and cargo operations.
After 2009, the split between air carrier jets and RJs is 90 seats with RJs having fewer than 90 seats.
Prior to 2010, the split between air carrier jets and RJs is 100 seats with RJs having fewer than 100 seats.
The 2011 Percentage between air carrier jets and RJs was incorrect and has been corrected in this graphic.

12 United States Code, 2006 Edition, Supplement 3, Title 49 – Transportation Subtitle VII – Aviation Programs Part A – Air Commerce and Safety, Subpart II, Economic Regulation, Chapter 417 - Operations or Carriers, Subchapter III - Regional Air Service Incentive Program, Sec. 41762 – Definitions – defines regional jet air carrier service to be aircraft with a maximum of 75 seats. Therefore, this report categorizes aircraft with 70-75 seats and below as regional jets and aircraft with 90 seats and higher aircraft as air carriers (Note: there are no aircraft types with 75 to 90 seats).

Compared to 2013, the 2014 number of average daily operations (Table 6-1) indicates a modest increase in air carrier activity, with overall commercial traffic increasing by 0.6 percent in 2014. In 2014 there was a continued shift of operations away from the smaller RJ aircraft to larger air carrier aircraft on many routes increasing the number of passengers carried but not operations. Several new airlines started service at Logan Airport in 2014 including Emirates and Hainan Airlines. There were also increases in flights by Delta Air Lines, Southwest Airlines, and JetBlue Airways. The number of RJ operations decreased between 2013 and 2014 (a decrease of almost nine operations per day). Night operations by commercial operators increased in 2014 compared to 2013 by approximately seven operations per night. The majority of the increase in operations is due to an increase in passenger and cargo flights at night as airlines expand destinations and the number of flights per day. Commercial non-jet operations decreased slightly between 2013 and 2014 (dropped from 135 operations per day to 131 operations per day).

General Aviation Operations

Modeled GA activity in 2014 rose slightly compared to 2013, from 71 operations per day in 2013 to 72 operations per day in 2014 (Table 6-1). Use of Stage 2 GA jets reduced to zero in 2014 from 0.3 operations per day in 2013. Data prior to 2000 are included in *Appendix H, Noise Abatement.*

Stage 2, Stage 3, and Stage 4 Jet Aircraft

Jet aircraft currently operating at Logan Airport are categorized by FAA into the three groups: Stage 2, Stage 3, and Stage 4. As described previously, the designation refers to a noise classification specified in FAR Part 36 that sets noise emission standards based on an aircraft's maximum certificated weight. Generally, the heavier the aircraft, the more noise it is permitted to make within the limits established by FAR Part 36.

Because of the noise differences among Stage 2, recertificated Stage 3, Stage 3 aircraft, and aircraft that meet Stage 4 requirements, Massport tracks operations by these categories to follow their trends. Table 6-2 provides the percentage of commercial jet operations by stage since 2009 with 2000 and 1990 reported for historical context. As noted by Table 6-2, 97 percent of the commercial jet fleet at Logan Airport met Stage 4 requirements in 2013 and in 2014.

Table 6-2 Percentage of Commercial Jet Operations by Part 36 Stage Category[1]

Year	Stage 4 Requirements[2]	Certificated Stage 3	Recertificated Stage 3[4]	Stage 2 Greater than 75,000 lbs.	Total
1990	N/A	51.1%	0.0%	48.9%	100%
2000	N/A	70.0%	21.0%[5]	9.0%	100%
2010	93.2%[3]	98.9%[3]	1.1%[5]	0.0%	100%
2011	95.5%[3]	99.5%[3]	0.5%[5]	0.0%	100%
2012	95.8%[3]	99.9%[3]	0.1%[5]	0.0%	100%
2013	97.4%[3]	100.0%[3]	0.0%	0.0%	100%
2014	97.4%[3]	100.0%[3]	0.0%	0.0%	100%

Source: Massport's Noise Monitoring System, Revenue Office numbers, HMMH 2014.
Notes:
1 Data for years prior to 2010 are available in *Appendix H, Noise Abatement.*
2 Aircraft that meet Stage 4 requirements are aircraft that are certificated Stage 4 or would qualify if recertificated. Certificated Stage 4 aircraft were not available until 2006 and the level of aircraft that meet Stage 4 requirements has not been determined prior to 2008.
3 All aircraft listed as meeting Stage 4 requirements are also listed as Stage 3 aircraft.
4 Recertificated Stage 3 aircraft are aircraft originally manufactured as a certificated Stage 1 or 2 aircraft under FAR Part 36 that either have been retrofitted with hushkits or have been re-engined to meet Stage 3 requirements.
5 Prior to 2013, only one commercial carrier, with more than 100 annual operations, continued to use recertificated Stage 3 aircraft at Logan Airport (Federal Express). A few charter operators also use these aircraft.

Nighttime Operations

Although Stage 2 aircraft over 75,000 pounds have been banned since January 1, 2000, aircraft certificated as Stage 2, which weigh less than 75,000 pounds, have continued to operate in the U.S. The Stage 2 aircraft currently allowed to operate are small corporate jet aircraft that are primarily in the GA fleet. However, FAA has issued a final ruling[13] on a prohibition of these aircraft operations after December 31, 2015. Logan Airport's Noise Rules prohibit Stage 2 aircraft of less than 75,000 pounds from using the Airport between the hours of 11:00 PM and 7:00 AM. In 2014, there were no Stage 2 operations at any time of day.

In addition, Massport monitors flights that operate between the broader DNL nighttime periods of 10:00 PM to 7:00 AM, when each modeled flight is penalized 10 dB in calculations of noise exposure. Table 6-3 shows this nighttime activity by different groups of aircraft. Nighttime flights by commercial jet operations increased by 6.6 percent between 2013 and 2014. Nighttime flights by commercial non-jet operations decreased by 29.0 percent from 2013 to 2014. Nighttime flights by GA operations decreased by 8.0 percent from 2013 to 2014. These changes resulted in an overall increase in nighttime operations of 5.0 percent in 2014. The majority of nighttime operations (between 10:00 PM and 7:00 AM) occurred either before midnight or after 5:00 AM. These nighttime operations represent 13.2 percent of total operation for 2014 at Logan Airport.

Table 6-3 Modeled Nighttime Operations (10:00 PM to 7:00 AM) at Logan Airport Per Night[1]

	Commercial Jets	Commercial Non-Jets	General Aviation	Total
1990	77.24	11.72	NA[2]	88.96
2000	103.92	21.58	5.68	131.19
2010	107.93	5.21	3.97	117.10
2011	109.38	4.73	6.65	120.76
2012	106.55	3.06	8.52	118.13
2013	115.91	3.21	6.28	125.40
2014	**123.6**	**2.28**	**5.78**	**131.66**
Change (2013 to 2014)	**7.69**	**-0.93**	**-0.5**	**6.26**
Percent Change	**6.64%**	**-29.06%**	**-7.99%**	**4.99%**

Source: Massport and Exelis radar data. HMMH, 2014.
Note:
1 Data for years prior to 2010 are available in *Appendix H, Noise Abatement*.
2 Totals prior to 1998 do not include GA operations

Cargo operations accounted for 7.2 percent of all commercial nighttime operations in 2013 and 6.1 percent in 2014. Nighttime Cargo operations decreased slightly from 2013 to 2014 (reduced by 0.5 operations per night) but are a smaller percentage due to the larger increase of passenger nighttime operations.

13 FAA Final Rule "Adoption of Statutory Prohibition on the Operation of Jets Weighing 75,000 Pounds or Less that Are Not Stage 3 Noise Compliant", issued July 2, 2013 Federal Register, Volume 78 Issue 127.

Similar to conditions reported in 2013, flights by cargo operators using recertificated Stage 3 aircraft made up almost no commercial nighttime activity in 2014. For comparison, in 2000, flights by cargo operators using recertificated Stage 3 aircraft accounted for 8.0 percent of the commercial nighttime activity. Though ICAO and the FAA are not expected to require the phase-out of the remaining recertificated operations prevalent among cargo operators, the use of these aircraft will continue to remain at a minimum as these aircraft age and are taken out of service.

Increases to nighttime commercial activity were due to passenger operations primarily resulting from the overall growth in domestic air carrier flights. In addition to this however, nighttime operations on new routes to European and Middle Eastern destinations were introduced in 2014 and also contributed to the overall increase in 2014 nighttime activity.

Runway Use

Logan Airport's runways are shown in Figure 6-2. Runway use refers to the frequency of which aircraft utilize each of these runways during the course of the year, as dictated or permitted by availability, wind, weather, aircraft performance, demand, and air traffic control conditions. Runway 15R-33L and Runway 4R-22L are Logan Airport's longest runways; each is just over 10,000 feet in length.

In 2014, Runway 15R-33L was the preferred runway to use at night to reduce community noise, with arrivals to Runway 33L and departures from Runway 15R, (known as the head-to-head procedure) thus keeping flights over Boston Harbor (these flights do fly over South Shore communities but at relatively high altitudes).

However, due to safety concerns FAA halted the use of head-to-head operations at airports across the U.S. in June 2014. During this period (which is defined as Midnight to 6:00 AM for reporting purposes) when compared to the first half of the year the following changes were noted (see Table 6-4):

- Arrivals to Runway 33L decreased by 31 percent and to Runway 4R by 4 percent;
- Departures from Runway 15R decreased by 12 percent and from Runway 9 by 5 percent;
- This change was in effect for only half of the year, however it had a greater effect because it was during the nighttime period, when noise events are assigned a 10 dB penalty and the change distributed flights over residential communities;
- These changes resulted in increased flights over residential areas and increased noise complaints during the overnight period in 2014; and
- These changes increased the use of other runways during this period as shown in Table 6-4.

Table 6-4 Change in Late Night Runway Use – Before and After June 16, 2014

Runway	Change in Arrivals (%)	Change in Departures (%)
4R	**(4.1)**	2.4
9	0.0	**(4.9)**
15R	6.4	**(12.0)**
22L	19.2	1.9
22R	0.0	3.6
27	9.2	3.3
33L	**(30.6)**	5.8

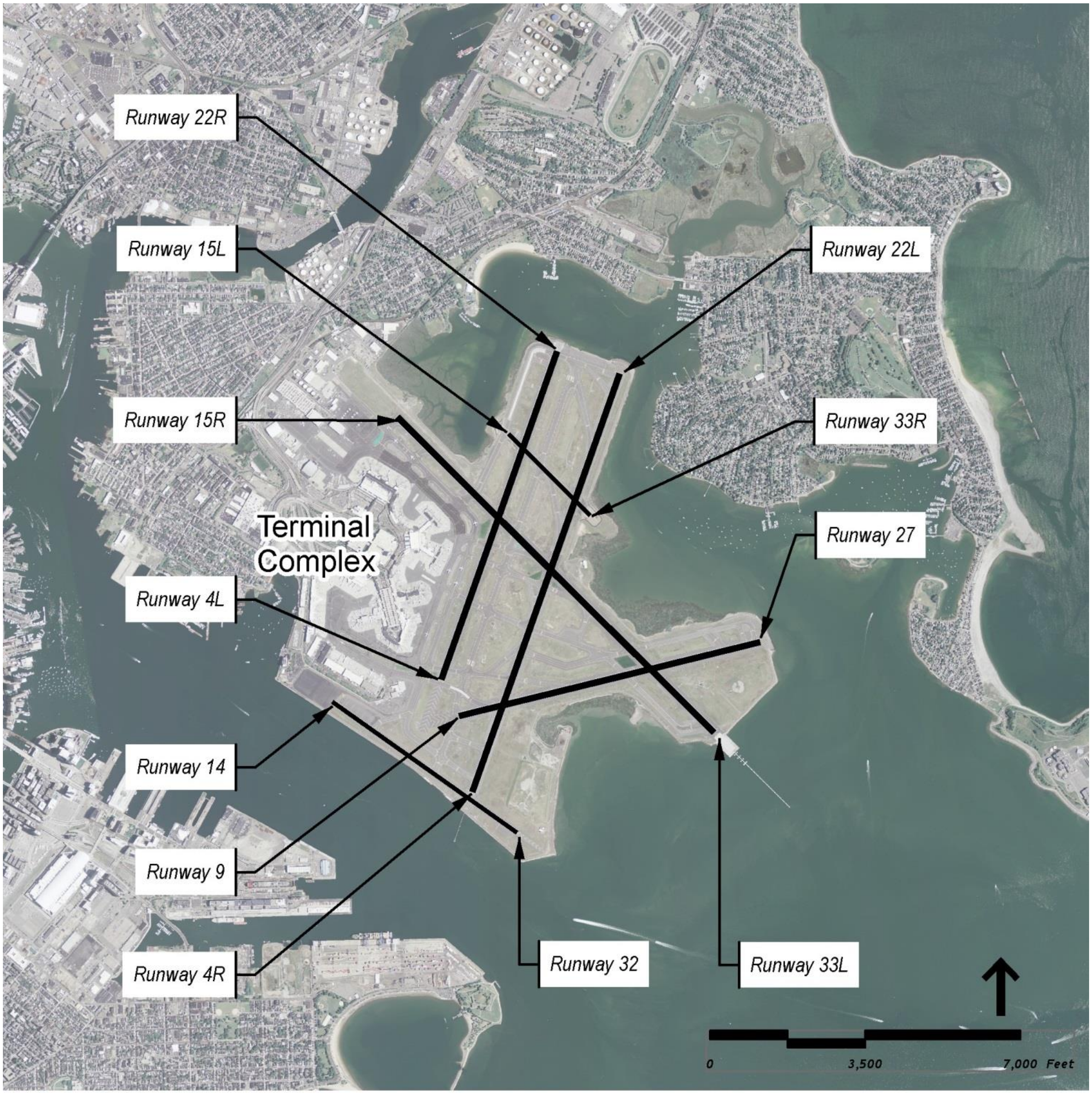
Notes: Runways not shown (4L, 14, 15L, 32, 33R) had no use during this period
Bold values are decreases in activity.
Time period evaluated (Midnight to 6:00 AM)

During other periods of the day, Runway 9 is used primarily for departures, and Runway 4R is used primarily for arrivals. Runway 22R is primarily used for departures, and Runways 15R, 27, 22L and 33L are used for both arrivals and departures.

FAA suspended Converging Runway Operations (CRO) in January of 2014. Runway 27 and Runway 22R are known as CRO runways since their extended centerlines cross within a short distance. These operations were suspended due to safety concerns primarily when aircraft are departing Runway 22R and landing on Runway 27. While Runway 22R is in use for departing aircraft, arrivals that would typically be directed to Runway 27 were sent by the FAA Air Traffic Control to arrive on Runway 22L.

Runway 14-32 is unidirectional; there are no arrivals to Runway 14 and no departures from Runway 32. Additionally, Runway 14-32 can be used only during northwest or southeast wind conditions when winds are 10 knots or greater. Under certain northwest wind conditions, Runway 32 provides the FAA with a second arrival runway, thereby reducing delays at the Airport. Runway 14 is available for departures but is rarely used in that manner. Runway 15L-33R is Logan Airport's shortest runway at under 3,000 feet long. This runway is primarily used for small non-jet aircraft arrivals.

Figure 6-2 Logan Airport Runways



Source: HMMH, Inc. 2015, U.S. Department of Agriculture, National Agriculture Imagery Program (NAIP), 2014.

Jet runway use conditions in 2014 are summarized in Table 6-5 and were as follows:

- Combined arrivals to Runways 4L and 4R remained at 35 percent in 2014 as in 2013. In 2014, departures from Runway 4R decreased by 1.0 percent to 5.0 percent in 2014.
- For 2014, arrivals to Runway 22L increased by 9.0 percent to 25 percent, with departures remaining at 2.0 percent compared to 2013. Runway 22R departures decreased by 7.0 percent to 28 percent in 2014. Runways 22R and 9 consistently remained the most used departure runways at Logan Airport.
- Departures on Runway 27 increased by 1.0 percent to 13 percent in 2014. Departures on Runway 9 increased 1.0 percent to 31 percent in 2014. Arrivals to Runway 27 decreased substantially from 32 percent in 2013 to 21 percent in 2014.
- Since opening in late November 2006, Runway 14-32 has been used primarily for arrivals of RJs and turboprops over Boston Harbor, consistent with FAA operations restrictions based on wind direction (NW or SE) and speed (greater than 10 knots).
- Departures from Runway 33L increased from 12 percent in 2013 to 17 percent in 2014 with arrivals increasing slightly from 15 percent in 2013 to 16 percent in 2014. Runway 15R departures remained the same as 2013 at 2 percent with Runway 15R arrivals increasing from 1 percent to 2 percent in 2014.

Runway use for all aircraft types (Jet and Non-Jet) for 2013 and 2014 is provided in *Appendix H, Noise Abatement.*

Table 6-5	Summary of Annual Jet Aircraft Runway Use[1]									
	Runway									
	4L	4R	9	14[2]	15R	22L	22R	27	32[2]	33L
1990										
Departures	0%	3%	21%	NA	10%	2%	36%	20%	NA	7%
Arrivals	1%	25%	0%	NA	2%	14%	0%	28%	NA	29%
2000										
Departures	0%	8%	35%	NA	4%	3%	30%	15%	NA	6%
Arrivals	4%	40%	0%	NA	1%	7%	0%	28%	NA	20%
2010										
Departures	5%	28%	0%	-	1%	15%	0%	32%	1%	16%
Arrivals	0%	4%	28%	<1%	8%	2%	31%	10%	-	17%
2011										
Departures	0%	6%	36%	<1%	5%[3]	2%	36%	7%	-	7%[3]
Arrivals	7%	37%	0%	-	<1%[3]	16%	0%	28%	1%	11%[3]
2012										
Departures	<1%	6%	34%	<1%	4%[3]	3%	38%	6%	-	8%[3]
Arrivals	6%	34%	0%	-	1%[3]	16%	<1%	34%	<1%	9%[3]
2013										
Departures	<1%	5%	30%	<1%	5%	2%	35%	12%	-	12%
Arrivals	6%	29%	0%	-	1%	16%	<1%	32%	1%	15%
2014										
Departures	0%	5%	31%	<1%	5%	2%	28%	13%	-	17%
Arrivals	5%	30%	0%	-	2%	25%	<1%	21%	1%	16%

Source: Massport Noise Office and HMMH, 2014.

Notes: These data reflect actual percentages of jet aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the Preferential Runway Advisory System (PRAS) to derive recommendations for use of a particular runway.
Jet aircraft are not able to use Runway 15L or 33R due to its length of only 2,557 feet.
Values may not add to 100 percent due to rounding.
NA = Not Available.

1 Data for years prior to 2010 are available in *Appendix H, Noise Abatement.*
2 Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32).
3 Runway 15R-33L was closed for 3 months in 2011 and 2012.

Preferential Runway Advisory System (PRAS)

Developed in 1982 and enhanced in 1990 and subsequent years, the PRAS is a set of short-term and long-term runway use goals that include the use of a computer program that recommends to FAA air traffic controllers runway configurations that will meet weather and demand requirements and provide an equitable distribution of Logan Airport's noise impacts on surrounding communities. The two primary objectives of the PRAS goals are to distribute noise on an annual basis and to provide short-term relief from continuous operations over the same neighborhoods at the ends of the runways.

In February 2004, the FAA upgraded to the Standard Terminal Automation Replacement System (STARS) and Integrated Information Display & Dissemination System version 5 (IDS5)[14] radar during the consolidation of the Boston Terminal Control Center (TRACON) at the new facility in Merrimack, New Hampshire. As a result of this upgrade, a shutdown of the PRAS system computer was necessary. Updated PRAS software was installed in 2007. Technical difficulties related to processing input from the FAA's IDS5 system have continued.

During Phase 2 of the on-going BLANS the Logan Airport CAC voted to abandon PRAS because it had not achieved the intended noise abatement.[15] Phase 3 of the BLANS is focusing on the development of an updated Runway Use Program. Operational tests of a new program began in November 2014 and will continue throughout 2015.

For this *2014 EDR*, Massport continues to present the annual comparison data to the PRAS goals.
Under the PRAS, each runway end has a specific annual utilization goal, defined separately for departures and arrivals. The goals are defined in terms of effective usage, which applies a factor of 10 to nighttime (10:00 PM to 7:00 AM) operations, equivalent to increasing nighttime exposure by 10 dB so that a change in effective utilization is roughly proportional to the change in DNL.

Table 6-6 provides a comparison of effective runway use[16] in 2014 to that of 2013, 2012, and to the PRAS goals. The 2014 utilizations shown in bold indicate improvements toward the goals for each runway compared to 2013. The effective jet runway use in 2014 moved closer to the PRAS goals. Four of the arrival percentages moved closer to the PRAS goals in 2014 and five of the departure percentages moved toward the PRAS goals.

Table 6-6 Effective Jet Aircraft Runway Use in Comparison to PRAS Goals

Runway End	PRAS Effective Usage Goals		2012 Effective Usage		2013 Effective Usage		2014 Effective Usage	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
4R/L	21.1%	5.6%	**32.3%**	5.7%	34.6%	4.6%	**28.1%**	**4.9%**
9	0.0%	13.3%	0.0%	**28.0%**	0.0%	29.9%	0.0%	**24.2%**
15R	8.4%	23.3%	**0.8%**	14.7%	**1.0%**	4.9%	**2.1%**	**11.6%**
22L/R	6.5%	28.0%	26.3%	37.8%	**16.0%**	**36.6%**	30.4%	**29.2%**
27	21.7%	17.9%	25.5%	6.5%	32.1%	**11.6%**	**15.4%**	**15.0%**
33L	42.3%	11.9%	15.0%	7.3%	**15.3%**	**12.4%**	**23.4%**	15.1%
14[1]	NA	NA	-	<0.1%	-	<0.1%	0.0%	<0.1%
32[1]	NA	NA	0.2%	-	0.9%	-	0.6%	0.0%

Source: Massport Noise Office and HMMH, 2014.
Notes: PRAS goals are stated in terms of effective jet operations which exclude non-jet flights, but which multiply each nighttime (10:00 PM to 7:00 AM) operation by a factor of 10.
PRAS goals have not yet been established for Runways 14 and 32.
Bold text indicates runways use that is closer to PRAS goals from the prior year.
Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32).

14 STARS is FAA's replacement radar equipment and software for TRACON and tower facilities. Integrated Information Display & Dissemination System version 5 (IDS5) is an advanced information management toolset designed for air traffic control by Systems Atlanta, which works with the STARS system.
15 BLANS Level 3 Screening Analysis, FAA, December 2012, Page E-2.
16 Effective Runway use refers to runway use which applies a factor of 10 to the night operations similar to DNL.

Flight Tracks

As described in the Methodology section, Massport continued to use the pair of software packages known as RealProfiles™ and RealContours™. *Appendix H, Noise Abatement* provides a summary discussion of RealProfiles™ and RealContours™. The software package RealContours™ is used to develop the INM inputs based on available radar tracks. Instead of using representative model tracks, RealContours™ converts each radar track to an INM model track and then models the scaled operation on that track.[17] This allows Massport to take into account runway closures and/or temporary or permanent airspace changes which occur during the year.

For this *2014 EDR*, 345,090 flight tracks were modeled to calculate the noise levels surrounding Logan Airport for calendar year 2014. Figures 6-3 through 6-9 provide examples of flight tracks used with RealContours™ to develop the 2014 contours.[18] The figures show arrivals and departures separately for each of three aircraft categories: air carrier jets, RJs, and non-jets. The following figures are from April 2014, when the runway use was similar to the 2014 yearly average presented previously.

Additional figures and associated text at the end of this chapter describe the RNAV[19] standard instrument departure (SID) procedure and any changes that were in effect during 2014. The RNAV procedures implemented at Logan Airport are part of a national FAA initiative which is being implemented to improve safety and efficiencies in the airspace system. These procedures result in consolidated flight paths and greater predictability along the flight route. Similar procedures have been implemented at Denver, Minneapolis, Chicago Midway, and Seattle.

- Figure 6-3 displays air carrier jet departures following the recommended departure routes. The departure procedures reflect updated FAA RNAV routes implemented in 2013 and 2014, shown in this graphic. The Runway 33L RNAV procedure was first implemented by the FAA in June of 2013.
- Figure 6-4 displays air carrier jet arrivals. The RNAV arrival procedures are very evident in the 2014-modeled data with a narrowing of the flight tracks into concentrated areas.
  - In the beginning of 2014, JetBlue Airways conducted a test of a RNAV visual approach procedure[20] which overlays the standard visual approach to Runway 4L. This procedure is visible arriving over Dorchester to line up on final approach and would give aircraft with advanced navigational capabilities a more stabilized approach to the visual Runway 4L.
- Figure 6-5 displays the RJ departures following the RNAV departure routes with flights remaining north of the Hull peninsula and passing over the Nahant Causeway.

17 This method provides a one to-one correspondence of radar tracks to model tracks and ensures that the lateral and vertical dispersion of aircraft types are consistent with the radar data.
18 Runway use from each month was developed and compared to the annual runway use information. April 2014 provided the closest match to annual results.
19 RNAV enables aircraft to fly on any desired flight path within the coverage of ground or space-based navigation aids, or within the limits of the capability of aircraft self-contained systems, or a combination of both capabilities.
20 Boston-Logan Runway 4 Left Area Navigation RNAV Visual Flight Procedure Test CATEX, approved 6/26/2013.

- Figure 6-6 displays the RJ arrivals that utilize both east and west sides of the Airport for arrivals. Arrivals to Runway 32 are also displayed on this graphic.
- Figure 6-7 displays the non-jet departures that tend to turn early off the runways and do not follow the jet departure routes. Non-jet departures from Runways 4L, 22R, 33L, and 27 are allowed to turn over populated areas whereas the jet aircraft are not. This also keeps the non-jet aircraft out of the jet departure paths allowing for efficient jet departures.
- Figure 6-8 displays the non-jet arrivals and includes the Boston Harbor route for non-jet aircraft arriving to Runway 4L. The graphic also displays the non-jet arrivals to Runways 22R and 33R in addition to the other runways, which also accommodate jets.
- Figure 6-9 displays the night jet arrivals using the Light Visual Approach[21] to Runway 33L during April 2014. This is a procedure developed from the BLANS project, which is available only during visual conditions in which pilots can follow a route offshore to reduce noise impacts. These flights remain offshore and avoid overflying Cohasset and Hull at night. Flights arriving to Runway 33L from the west pass over Saugus and Nahant at a higher altitude and then head south over the Boston Harbor to intersect with the visual approach procedure.
  - In the fall of 2013, JetBlue Airways began a test of an RNAV visual approach procedure[22] which overlays the standard visual approach. This procedure would give aircraft with advanced navigational capabilities a more stabilized approach to the visual Runway 33L. Use of this procedure can be seen in the April 2014 tracks in Figure 6-9.

Meteorological Data

The INM has several settings that reflect aircraft performance profiles and sound propagation based on meteorological data. Meteorological settings include average temperature, barometric pressure, and relative humidity at the Airport. Massport obtained weather data for 2014 from the National Climatic Data Center (NCDC). Average daily values for each of the settings were used in the development of the 2014 noise conditions. The average conditions for each day allowed the modeling system used by Massport to develop performance profiles based on each day's conditions and allowed the INM model to use each day's conditions to assess the propagation of noise. The use of daily values allows the INM to better model aircraft profiles on days significantly different than the average, such as during the winter and summer months.

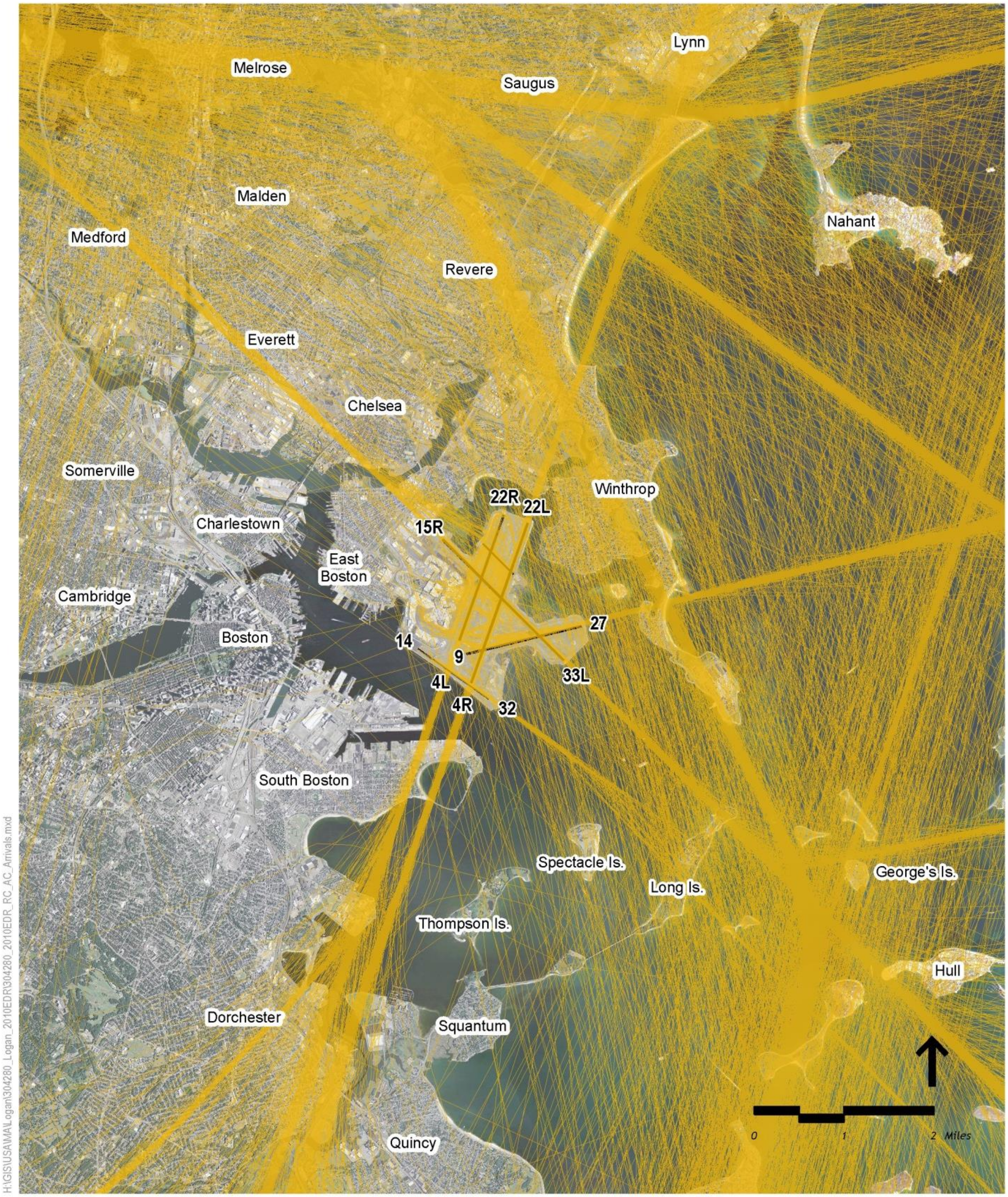
21 A Visual Approach procedure can only be used when weather conditions permit and the pilots follow visual landmarks to follow the procedure.
22 Boston-Logan Runway 33 Left Area Navigation RNAV Visual Flight Procedure Test CATEX, approved 6/26/2013.

Source: Massport, Exelis NOMS, MassGIS, USDA NAIP 2014.

RealContours™ Air Carrier Jet Departure Tracks (April 2014)

Figure 6-3

Departure Flight Tracks (April 2014)



Source: Massport, Exelis NOMS, MassGIS, USDA NAIP 2014.

RealContours™ Air Carrier Jet Arrival Tracks (April 2014)

Arrival Flight Tracks (April 2014)

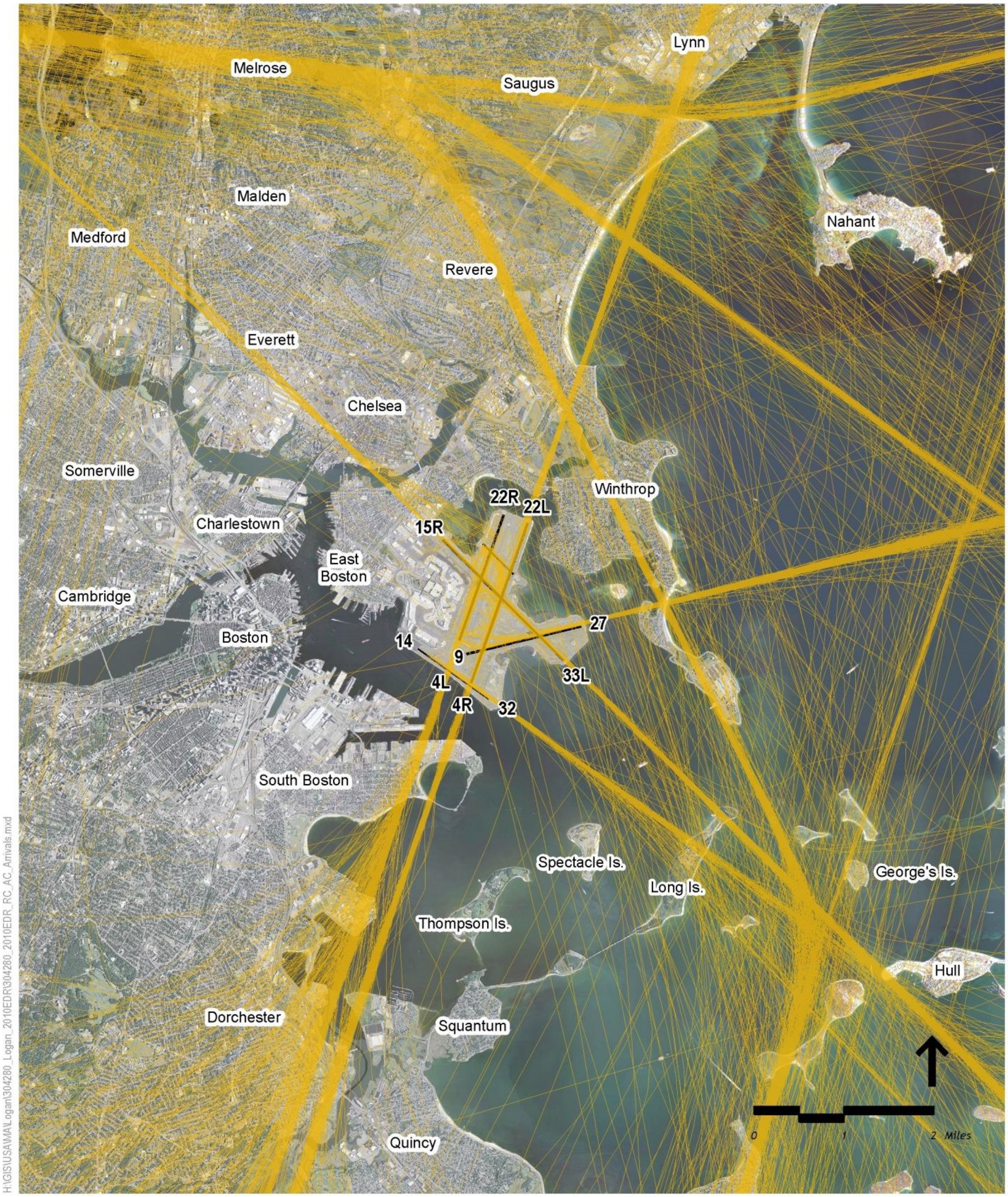
Figure 6-4

Source: Massport, Exelis NOMS, MassGIS, USDA NAIP 2014.

RealContours™ Regional Jet Departure (April 2014)

Departure Flight Tracks (2014)

Figure 6-5

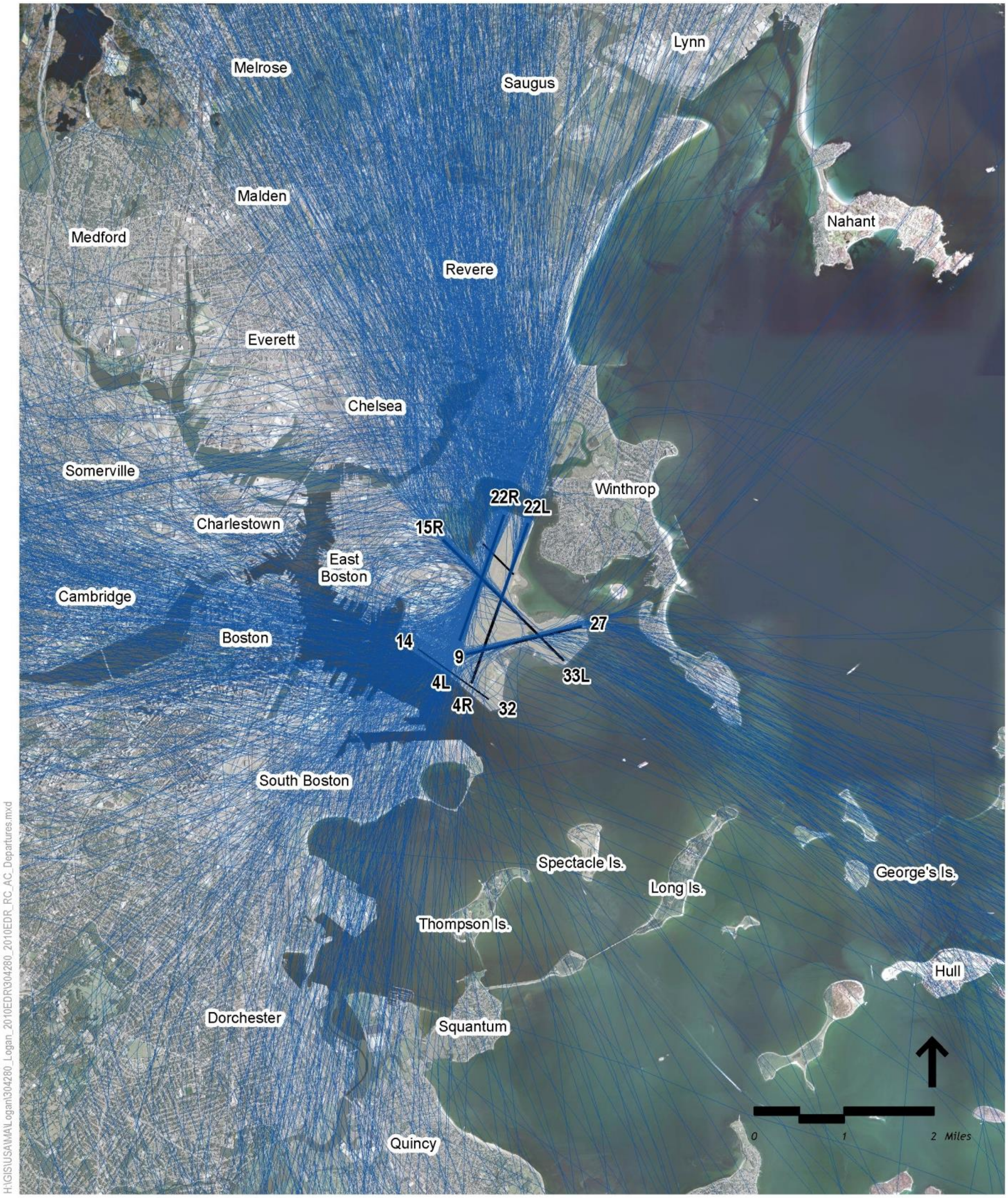


Source: Massport, Exelis NOMS, MassGIS, USDA NAIP 2014.

RealContours™ Regional Jet Arrival Tracks (April 2014)

Arrival Flight Tracks (2014)

Figure 6-6

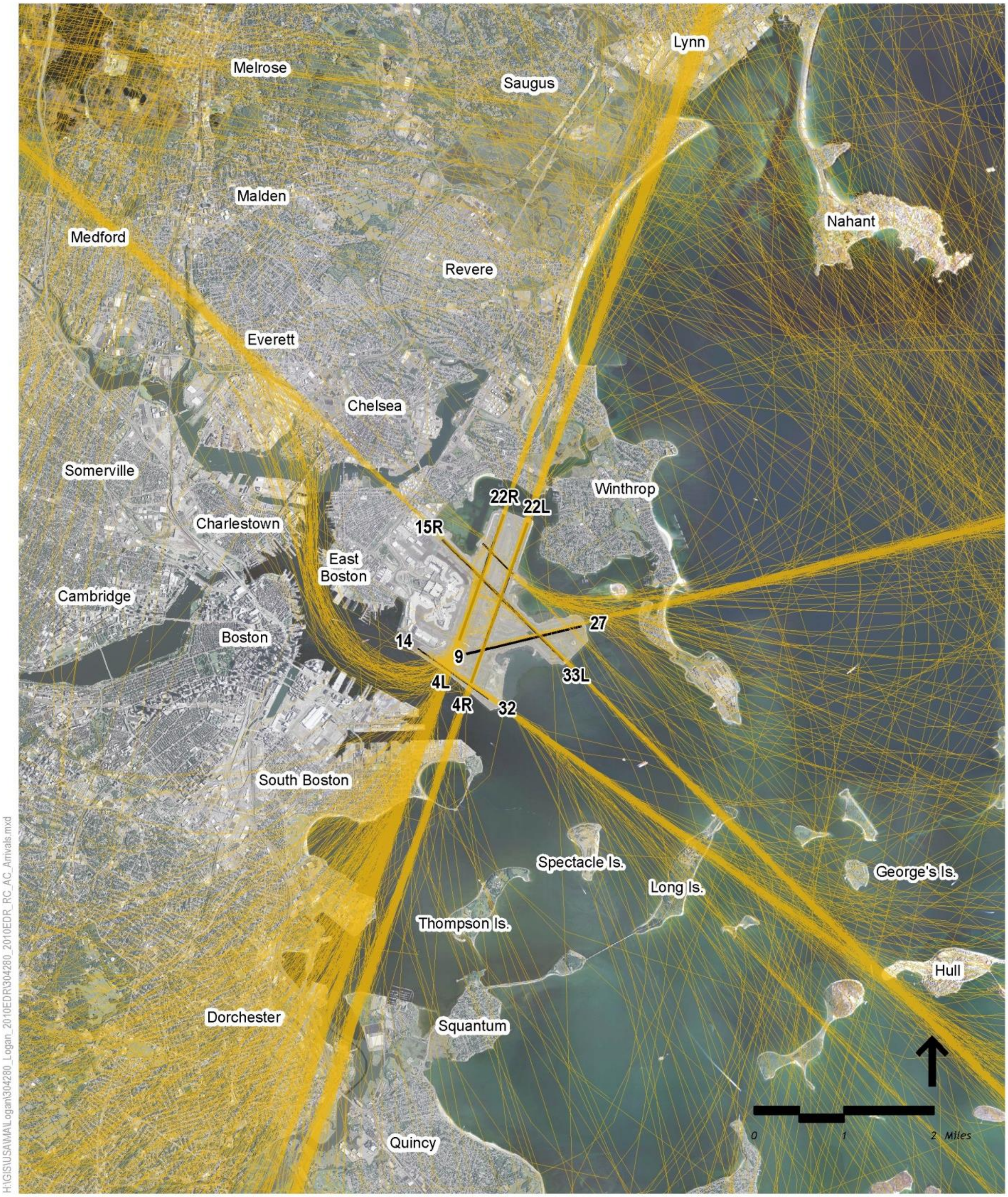


Source: Massport, Exelis NOMS, MassGIS, USDA NAIP 2014.

RealContours™ Non-Jet Departure Tracks (April 2014)

Departure Flight Tracks (2014)
Note: Non-Jet tracks are non-RNAV

Figure 6-7

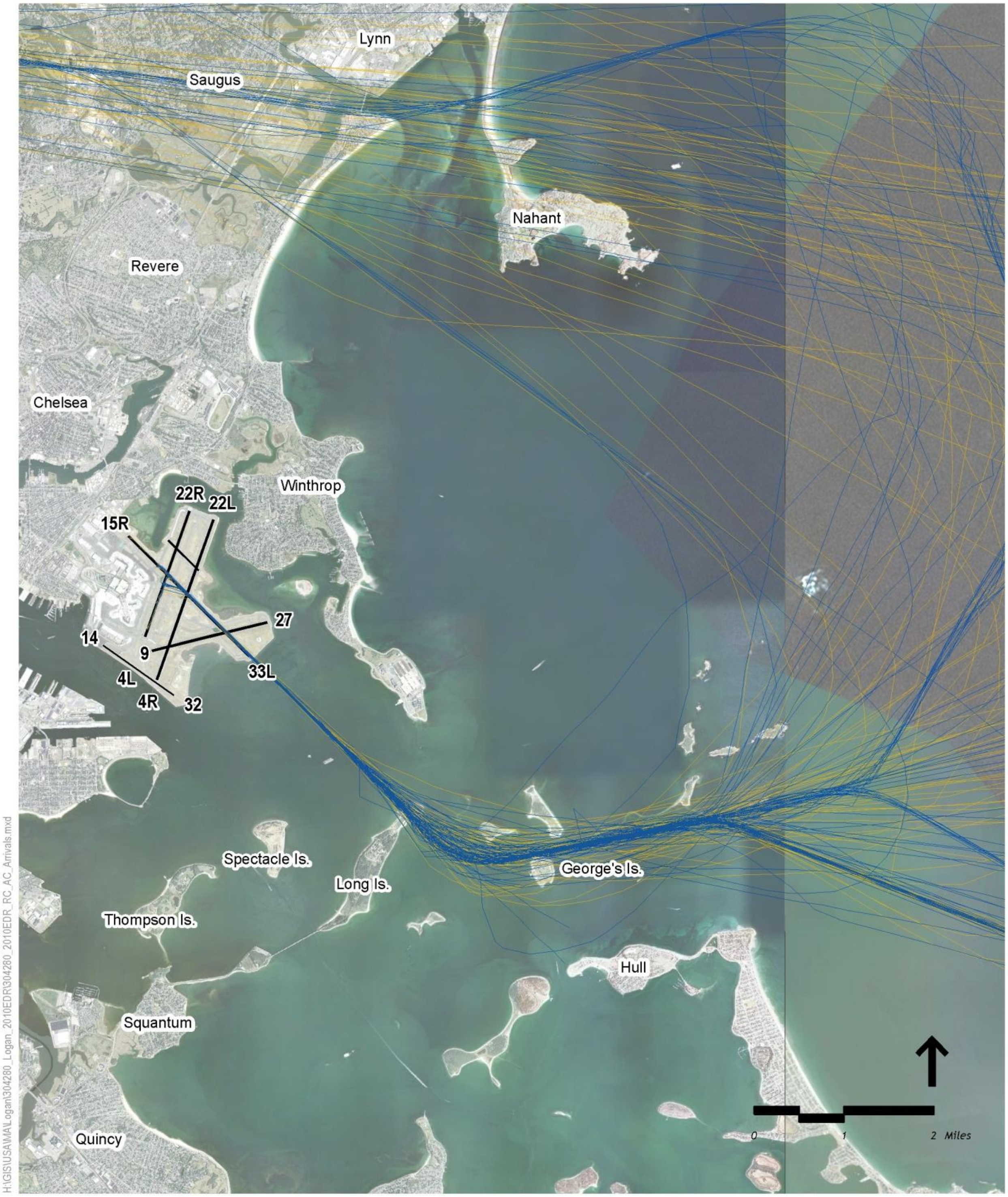


Source: Massport, Exelis NOMS, MassGIS, USDA NAIP 2014.

Arrival Flight Tracks (2014)
Note: Non-Jet tracks are non-RNAV

RealContours™ Non-Jet Arrival Tracks (April 2014)

Figure 6-8



Source: Massport, Exelis NOMS, MassGIS, USDA NAIP 2014.

Arrival Flight Tracks (2014)
Arrival Flight Tracks (2013)

Runway 33L Night (10:00pm - 07:00am)
Light Visual Approach Tracks (April 2014)

Figure 6-9

Noise Levels in 2014

Day-Night Noise Contours for 2014

The 2014 DNL contours were prepared using FAA's most recently available version of the INM (INMv7.0d) and are shown in Figure 6-10 for DNL values of 60, 65, 70, and 75 dB. Figure 6-11 provides a comparison of the DNL 65 dB contours for 2013 and 2014 and how they compare to the historical 1990 and 2000 DNL 65 dB contour. Generally contours at Logan Airport change slightly due to changes in runway use and fleet mix from one year to the next. However, in 2014 two temporary factors and one long term factor resulted in changes to the contour compared to 2013. All homes within the expanded contour are within the previously approved sound insulation areas. Both the 2013 and 2014 DNL contours in Figure 6-11 continue to include the FAA-approved adjustments for over-water sound propagation and hill effects in Orient Heights, unique to Logan Airport.

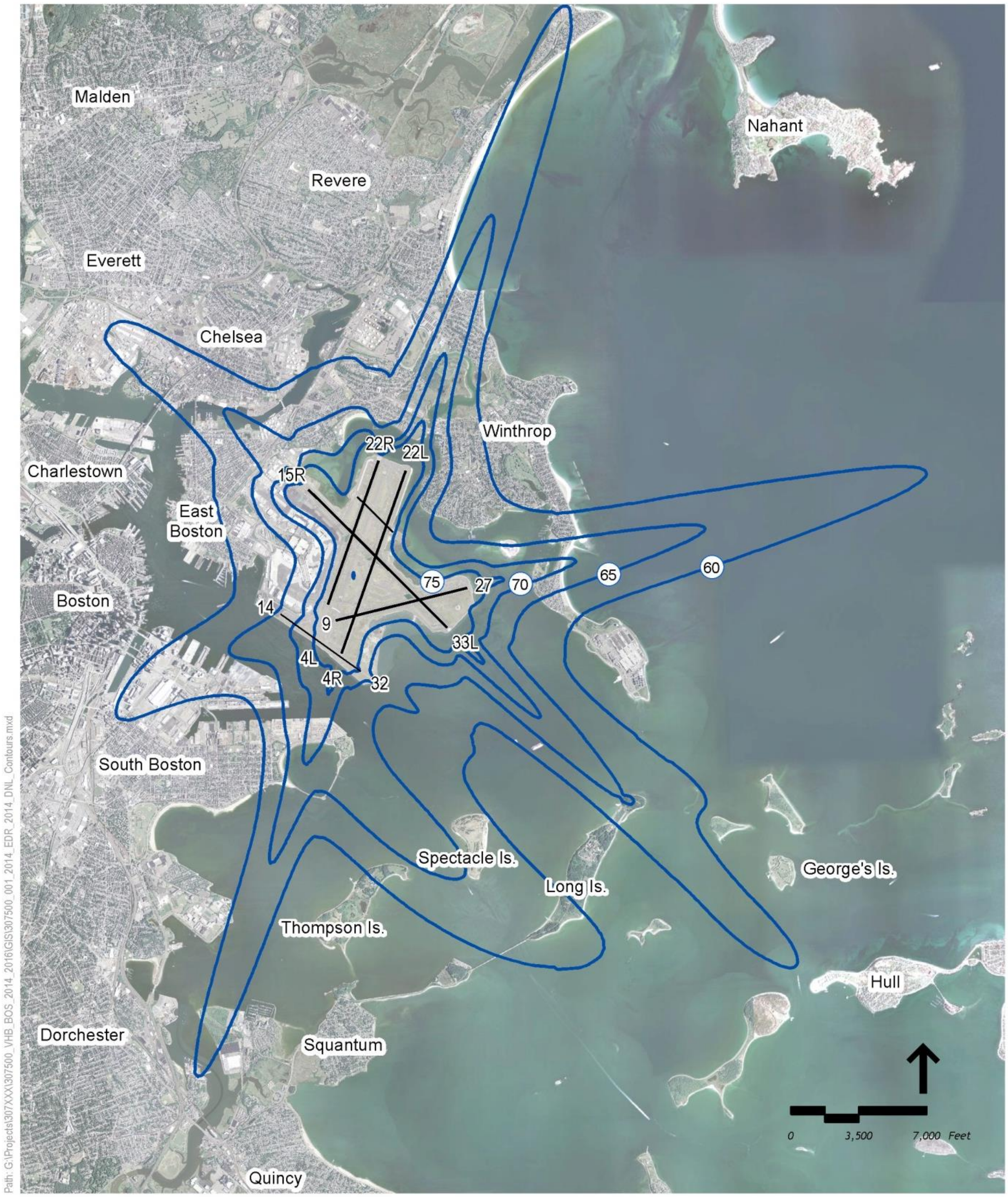
In general, the shapes of the 2014 DNL 60 and 65 dB contours differ from the 2013 contours for three primary reasons:

- Elimination of the head-to-head procedure resulted in expanded use of other runways at night. This change also resulted in one way use of Runway 15R-33L (both arrivals and departures to Runway 33L or arrivals and departures to Runway 15R). This extended suspension of the procedure resulted in DNL contour increases over East Boston (additional analysis of this suspension is provided towards the end of this chapter).
- FAA's increased use of Runway 22L for arrivals and reduction to Runway 27 due to Converging Runway Operations (CRO) also contributed to increases over Revere.
- The short term closure of Runway 15L-33R for Safety Area improvements including short term closures of intersecting Runways 4R-22L and 4L-22R resulted in higher uses of Runway 15R-33L.

In 2014 the first full year of RNAV use on all of Logan Airport's runways was in place and RNAV procedures tended to concentrate and elongate the contour. For the DNL 65 dB contour, this only applies to the contour lobe extending out over Boston Harbor from Runway 22L/R departures. The shape of the DNL 60 dB contour over Chelsea and South Boston also follows the RNAV routes.

The DNL 65 dB contour increased in size over Revere primarily due to increases in arrivals to Runway 22L. Over Winthrop, a small increase in the use of Runway 22L for departures at night and the arrivals to Runway 22L caused the DNL 65 dB contour to increase in extent. Over the Point Shirley section of Winthrop, the DNL contour remained similar in size, as arrivals to Runway 27 decreased but departures from Runway 9 increased. Slight increases in arrivals to Runway 33L and 32 resulted in the DNL contour expanding out over Boston Harbor. Departures from Runway 22R did not increase between 2013 and 2014; however use of the runway by heavier, larger aircraft especially at night resulted in increases out towards Spectacle Island. Increased used of Runway 27 departures resulted in the DNL contour increasing slightly towards South Boston. Daytime increases in departures from Runway 33L and arrivals to Runway 15R during the winter months resulted in the largest increase in the extent of the contour over East Boston in 2014.

It is important to note that the 2014 DNL 65 dB contour is within populated areas already sound insulated by Massport (refer to the Noise Abatement discussion presented later on in this chapter). See Figure 6-11.

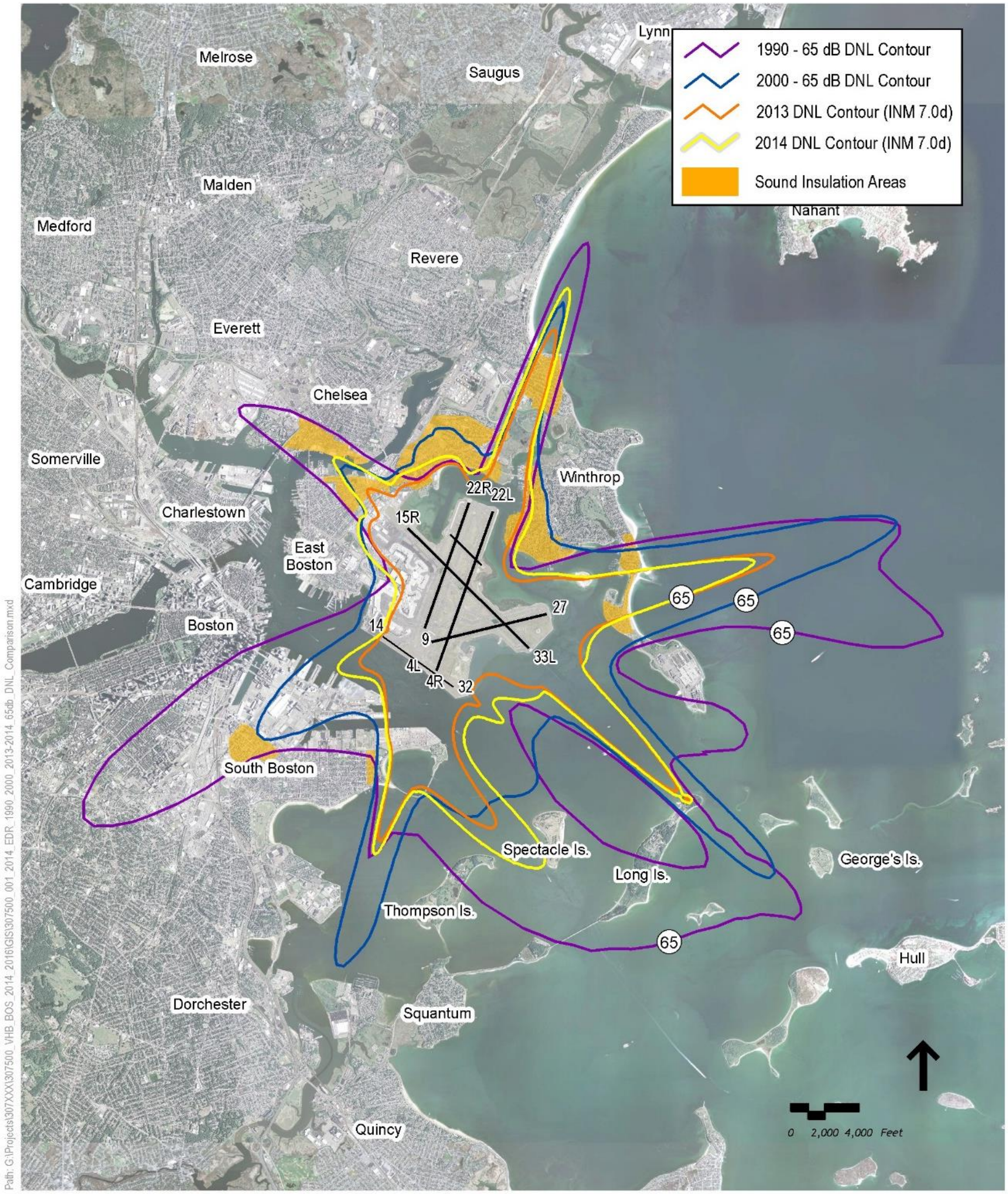


Source: HMMH, MassGIS, USDA NAIP 2014

60-75 DNL Contours for 2014 Operations Using INM 7.0d

Figure 6-10

2014 DNL Contour (INM 7.0d)



Source: HMMH, MassGIS, USDA NAIP 2014

Comparison of Historical and Current 65 dB DNL Contours - 1990, 2000, 2013, and 2014

Figure 6-11

Population Impact Assessment

Population counts within selected 5dB increments of exposure are reported each year to indicate how Logan Airport's noise environment changes over time. Population counts for 2014 are shown in Table 6-7 by community and are compared to previous years. The 2010 U.S. Census data, previously reported in the *2010 EDR,* were used to determine population counts. Population counts from 2000 through 2009 are based on U.S. Census data for 2000. *Appendix H, Noise Abatement* presents counts for calendar year 2010 from both sets of Census data. The 2010 Census data include updated population counts and can be used to demonstrate the changes in population in an area over a ten year period.

Both the FAA and the U.S. Department of Housing and Urban Development (HUD) consider DNL exposure levels above 65 dB to be incompatible with residential land use. Table 6-7 compares impacted populations for each year, using the latest INM results. The noise analysis is based upon the most recently FAA-approved INM model (Version 7.0d for 2014). Table 6-8 provides an additional breakdown of the estimated population in East Boston and South Boston residing within the DNL 65 dB contour.

The differences in affected population between 2013 and 2014 in Tables 6-7 and 6-8 are primarily due the elimination of the head-to-head procedure at night, shifting of arrival operations to Runway 22L due to Converging Runway Operations, and the short term closure of runways due to the construction of safety areas for Runway 15L-33R. The differences in the contours are attributed mostly to the increased usage, both day and night, of Runway 15R-33L. Shifts in the flight tracks due to the new RNAV procedures have little effect on the DNL 65 dB contour except for the departure turns from Runway 22L and 22R. These procedures also concentrate the flight tracks over a smaller area, which can tend to elongate the contours, but did not significantly change the contours for 2014.

Due to the combination of all these factors in 2014 , the total number of people exposed to DNL values greater than 65 dB increased to 8,922 people in 2014 from 4,307 people in 2013 (an increase of 4,615 people). All of the additional people within the DNL 70 dB contour compared to 2013 are located in East Boston and described in greater detail below. The number of people residing within the DNL 70 dB contour increased from 130 people in 2013 to 164 people in 2014. These levels are still well below the number of people exposed in 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB. All of the residences exposed to levels greater than DNL 65 dB in 2014 have been eligible to participate in Massport's RSIP.

Table 6-7 Noise-exposed Population by Community[1]

Boston						Revere					
Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL	Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
1990	**1990**	0	1,778	28,970	30,748	**1990**	**1990**	0	0	4,274	4,274
2000	**2000**	0	234	9,014[3]	9,248[3]	**2000**	**2000**	0	0	2,496	2,496
2010 (7.0b)	**2010**	0	0	689	689	**2010 (7.0b)**	**2010**	0	0	2,413	2,413
2011 (7.0b)	**2010**	0	0	331	331	**2011 (7.0b)**	**2010**	0	0	2,547	2,547
2011 (7.0c)	**2010**	0	0	331	331	**2011 (7.0c)**	**2010**	0	0	2,547	2,547
2012 (7.0c)	**2010**	0	0	439	439	**2012 (7.0c)**	**2010**	0	0	2,772	2,772
2012 (7.0d)	**2010**	0	0	421	421	**2012 (7.0d)**	**2010**	0	0	2,762	2,762
2013 (7.0d)	**2010**	0	0	612	612	**2013 (7.0d)**	**2010**	0	0	2,505	2,505
2014 (7.0d)	**2010**	0	34	4,151	4,185	**2014 (7.0d)**	**2010**	0	0	2,832	2,832

Chelsea						Winthrop					
Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL	Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
1990	**1990**	0	0	4,813	4,813	**1990**	**1990**	676	1,211	2,420	4,307
2000	**2000**	0	0	0	0	**2000**	**2000**	247	1,070	4,684	6,001
2010(7.0b)	**2010**	0	0	0	0	**2010 (7.0b)**	**2010**	0	130	598	728
2011 (7.0b)	**2010**	0	0	0	0	**2011 (7.0b)**	**2010**	0	130	939	1,069
2011 (7.0c)	**2010**	0	0	0	0	**2011 (7.0c)**	**2010**	0	130	939	1,069
2012 (7.0c)	**2010**	0	0	0	0	**2012 (7.0d)**	**2010**	0	200	1,325	1,525
2012 (7.0d)	**2010**	0	0	0	0	**2012 (7.0d)**	**2010**	0	200	1,186	1,386
2013 (7.0d)	**2010**	0	0	0	0	**2013 (7.0d)**	**2010**	0	130	1,060	1,190
2014 (7.0d)	**2010**	0	0	0	0	**2014 (7.0d)**	**2010**	0	130	1,775	1,905

Everett						All Communities					
Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL	Year	Census	> 75 DNL	70-75 DNL	65[2]-70 DNL	Total (65+)[2] DNL
1990	**1980**	0	0	0	0	**1990**	**1980**	676	2,989	40,477	44,142
2000	**2000**	0	0	0	0	**2000**	**2000**	247	1,304	16,194	17,745
2010 (7.0b)	**2010**	0	0	0	0	**2010 (7.0b)**	**2010**	0	130	3,700	3,830
2011 (7.0b)	**2010**	0	0	0	0	**2011 (7.0b)**	**2010**	0	130	3,817	3,947
2011 (7.0c)	**2010**	0	0	0	0	**2011 (7.0c)**	**2010**	0	130	3,817	3,947
2012 (7.0c)	**2010**	0	0	0	0	**2012 (7.0c)**	**2010**	0	200	4,536	4,736
2012 (7.0d)	**2010**	0	0	0	0	**2012 (7.0d)**	**2010**	0	200	4,369	4,569
2013 (7.0d)	**2010**	0	0	0	0	**2013 (7.0d)**	**2010**	0	130	4,177	4,307
2014 (7.0d)	**2010**	0	0	0	0	**2014 (7.0d)**	**2010**	0	164	8,758	8,922

Source: HMMH 2014, Massport.

Notes: Population counts for 2009 are based on the 2000 U.S. Census block data and the contours beginning in 2004 from the RealContours™ system. Population counts for 2010 through 2013 are provided for the 2010 U.S. Census block data (as indicated) and the contours are from the RealContours™ system.

1 Data for years prior to 2010 are available in *Appendix H, Noise Abatement*. 7.0b, 7.0c, and 7.0d refer to INMv7.0b, INMv7.0c, and INMv7.0d respectively.

2 65 dB DNL is the federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.

3 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

Due to the change in runway use in 2014, East Boston had an increase in the number of people exposed to noise levels DNL 65 dB or greater compared to 2013, the number of people exposed increased from 612 to 4,185. For historical context, noise impacts were greater in 2000 when 8,979 people were exposed to levels DNL 65 dB or greater in East Boston and 269 people in South Boston.

The higher use of Runways 4R for departures and Runway 22L for arrivals in 2014 resulted in 327 more people exposed to DNL 65 dB in Revere. There was also an increase of 715 people in Winthrop exposed to DNL 65 dB and above due to increased use of arrivals to Runway 22L and a small increase in night departures from Runway 22L. Similar to Boston, Winthrop has experienced a significant reduction in exposed population dropping from 6,001 in 2000 to 1,905 in 2014.

Table 6-8 Estimated Population within 65 dB[1] DNL Contour[2]

		Boston							
Year	Census Base	East Boston	South Boston	Total	Chelsea	Revere	Winthrop	Everett	All Communities
1990	**1980**	NA	NA	**30,748**	4,813	4,274	4,307	0	**44,142**
2000	**2000**	8,979[3]	269	**9,248[3]**	0	2,496	6,001	0	**17,745**
2010 (INMv7.0b)	**2010**	689	0	**689**	0	2,413	728	0	**3,830**
2011 (INMv7.0c)	**2010**	331	0	**331**	0	2,574	1,069	0	**3,947**
2012 (INMv7.0c)	**2010**	439	0	**439**	0	2,772	1,525	0	**4,736**
2012 (INMv7.0d)	**2010**	421	0	**421**	0	2,762	1,386	0	**4,569**
2013 (INMv7.0d)	**2010**	612	0	**612**	0	2,505	1,190	0	**4,307**
2014 (INMv7.0d)	**2010**	4,185	0	**4,185**	0	2,832	1,905	0	**8,922**
Change from 2013 (7.0d) to 2014 (7.0d)		3,573	0	**3,573**	0	327	715	0	**4,615**

Source: HMMH 2014, Massport.
Notes: Population counts for 2000 are based on the 2000 U.S. Census block data and for 1990 from the 1980 U.S. Census block data.
Population counts for 2010 through 2012 are provided for the 2010 U.S. Census block data (as indicated) and the contours are from the RealContoursTM system.
Within the DNL 65 dB contour there was difference reduction in the number of people between the two 2011 INM model runs.
1 65 dB DNL is the federally-defined noise criterion used as a guideline to identify where residential land use is considered incompatible with aircraft noise.
2 Data for years prior to 2010 are available in *Appendix H, Noise Abatement.*
3 These values reflect the effect of the FAA-approved terrain adjustment in Orient Heights.

The total population exposed to noise levels between DNL 70 to 75 dB increased in 2014 to 164 people. Compared to 2000, there has been a significant reduction in the people exposed to the higher noise levels. The number in Boston has dropped from 234 people exposed in 2000 to 34 in 2014. Revere has remained at zero compared to 2000 with Winthrop having reductions from 1,317 people exposed in 2000 to 130 in 2014.

Comparing Measured and Modeled Noise Levels

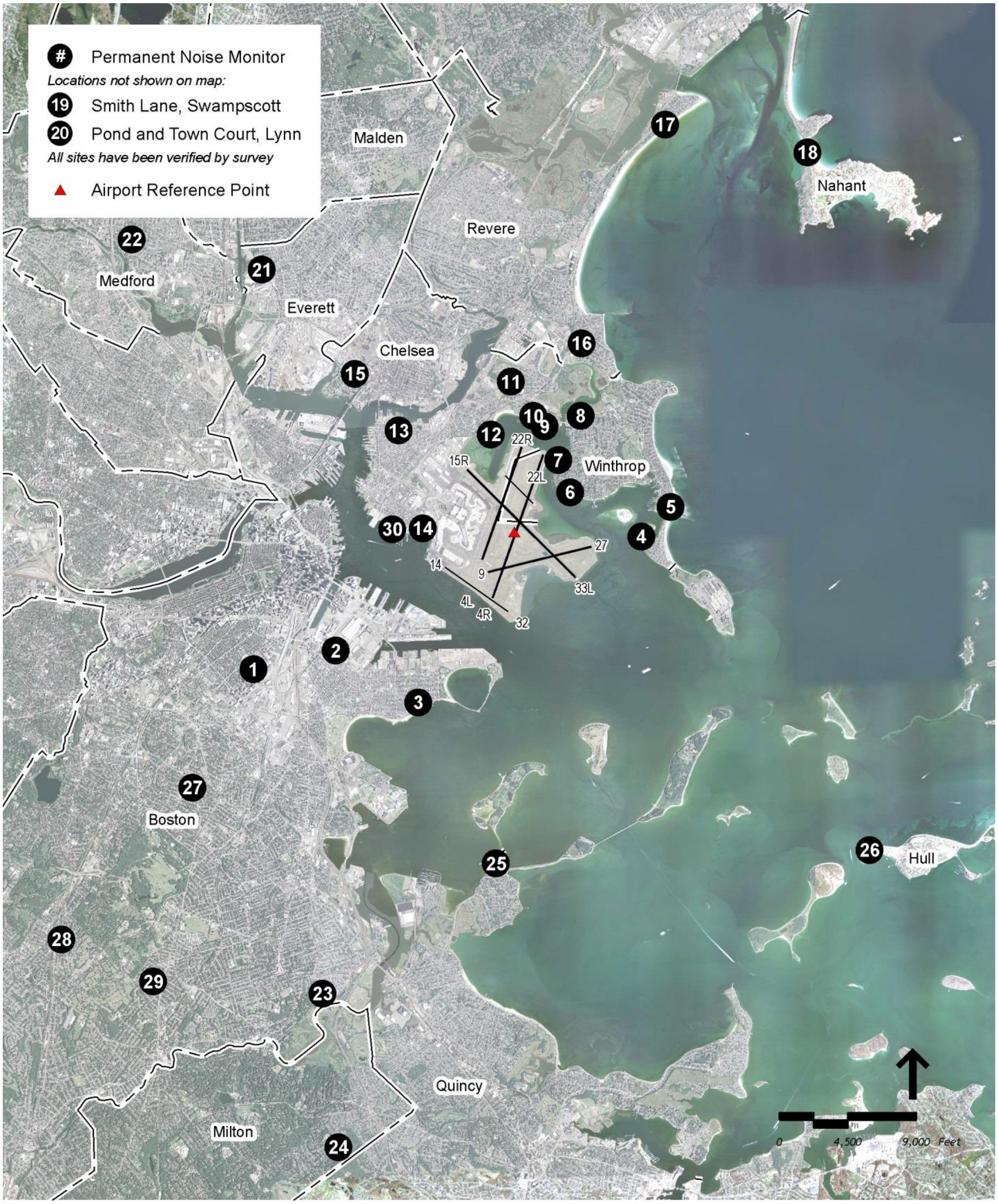
When changes in noise exposure are predicted by the INM, it is important to substantiate these modeled findings with actual noise measurements, such as those taken with Massport's permanent noise monitoring system. Massport's system continuously measures the noise levels at each of the 30 microphone locations around the Airport and environs, as shown in Figure 6-12. During normal operation, noise monitors at the microphone locations measure noise exposure levels as well as a variety of metrics associated with individual noise events that exceed preset threshold sound levels. Noise monitoring data are transmitted back to Massport's Noise Office, where daily DNL values and other noise metrics are computed for each location and summarized in various reports.

This *2014 EDR* compares the measured annual average DNL values from the monitors to INM-computed values of DNL at each of the specific noise monitor sites to check for reasonableness. Many sites produced small differences between measurements and predictions, particularly as adjustments were incorporated into the modeling process to account for the over-water sound propagation and hill effects. However, results at more distant locations have often produced substantial differences of 10 dB or more, especially at measurement sites where DNL values were often less than 60 dB. For 2013 and 2014, with the Airport's noise measurement equipment and monitoring system and its ability to correlate measured noise events with individual flight tracks, combined with the improvements in the INM database, differences between measured and modeled values have narrowed from the values even more than reported in previous EDRs and ESPRs.[23]

Aircraft altitude is a second factor that contributes to the differences between measured and modeled DNL values (especially at the more-distant noise monitoring sites). Typical noise modeling uses distance from origin to destination to determine the appropriate climb profile for an aircraft; however, many aircraft climb more slowly than the standard profiles would suggest, especially if the pilot must make a turn shortly after takeoff. By modeling the actual climb profile, instead of selecting the best fit among a standard set, better measured versus modeled results should be expected. This technique was applied and resulted in modeling lower altitudes over many of the farther out monitoring sites, which is a better reflection of reality, and further reduced the differences between measured and modeled sound levels at those locations. Finally, latitudes and longitudes of each measurement site were verified by survey and their exact coordinates entered into the INM. These improvements in modeling techniques are now fully integrated into the measured-versus-modeled INM comparisons that follow.

23 Several factors have resulted in better agreement between measured versus modeled levels. Beginning with the *2009 EDR*, flight track data and measurement data have come from the new monitoring system. The more accurate flight track data are used for the modeling inputs and for the measured aircraft event correlation.

Figure 6-12 Noise Monitor Locations



Source: HMMH 2010, MassGIS, USDA NAIP 2010.

Table 6-9 compares the measured 2013 DNL values to the measured 2014 DNL values at each location. Measured sound levels generally increased between 2013 and 2014. In 2014, three locations had decreases of more than 2 dB while eight had an increase of more than 2 dB; the remaining 16 locations had changes in levels of less than 2 dB. The average measured value for 27 of the sites was 55.5 dB in 2014, an increase from 54.4 in 2013 (Sites 3, 12 and 30 are excluded from the averages due to issues at each site). During 2013, Site 3 had issues due to noise interference from an outside source, which was resolved in 2014. Site 12 was decommissioned in 2010 and will be relocated at a future date. Site 30 also had an issue during 2014 and recorded a high DNL value. To keep the sites used for the averages consistent between the two years, Site 3, 12 and 30 were excluded from the computations.

Changes at various sites typically follow changes in runway use. For example, Site 22 in Medford, Site 15 in Chelsea, and Site 13 in East Boston all recorded increases of 2 dB or more due to the increased use of Runway 15R-33L. Site 24 in Milton increased slightly by 0.9 dB due to increased use of Runway 4L for arrivals, and Site 23 in Quincy also increased for the same reason.

Distances reported in Table 6-9 and Table 6-10 are computed from the Airport Reference Point which is located along Runway 4L-22R near the intersection with Runway 15R-33L. This location is shown on Figure 6-12. Table 6-10 compares the measured 2013 and 2014 DNL values at each measurement site to the modeled DNL values.

The average measured value for 27 of the sites is 55.5 dB in 2014 and the average modeled value is 58.4 dB in 2014 (Sites 3, 12 and 30 are excluded from the averages due to issues at each site). The average of the difference between the measured versus modeled values for 2013 is 2.8 dB, and 2.9 dB in 2014. In general, due to the modeled values being larger than the measured at most of the more distant monitors, the average difference will always be a positive value.

Using RealContours™, Massport is able to compute the modeled DNL for exactly the same periods for which the noise monitoring system was collecting data at each site. It is also able to capture runway use and airspace changes as they occur. The model however, only computes noise from aircraft and while it includes terrain it does not include other factors such as local weather phenomenon and the influence such as shielding from local buildings and trees.

As shown in Table 6-10, nine of the sites in 2014 have a difference between measured and modeled less than 1 dB. In 2013 and 2014, for the majority of locations where modeled values exceed measured values, the measured levels are below DNL 60 dB. It is not unusual to experience differences between measured and modeled levels at the locations with lower measured DNL values. The monitor identification of aircraft noise events becomes more difficult, and long distance effects can reduce levels that the model cannot duplicate. Differences at these sites farther from the Airport can easily increase the overall difference between measured and modeled results. Site 13 at the East Boston High School matches well with the modeling and both the modeling and the measured levels reflect an increase, which is expected due to the increased traffic on Runway 15R-33L in 2014.

The measured data are not used to calibrate the model but are shown here to compare to the modeled values and in general, they should reveal similar trends. For example, both the measured and the modeled values in East Boston, Chelsea, and Medford increased due to the increased usage of Runway 15R-33L in 2014.

Table 6-9 Measured Versus Measured - Comparison of Measured DNL Values From 2013 to 2014

Location	Site	Distance from Logan Airport (miles)	2013 Measured Aircraft (DNL)	2014 Measured Aircraft (DNL)	Difference 2014 minus 2013
South End – Andrews Street	1	3.7	54.6	56.0	1.4
South Boston – B and Bolton	2	2.9	54.1	56.6	2.5
South Boston – Day Blvd. near Farragut	3	2.5	69.5	60.5	(9.0)
Winthrop – Bayview and Grandview	4	1.6	71.2	71.0	(0.2)
Winthrop – Harborview and Faun Bar	5	1.9	63.2	63.4	0.2
Winthrop – Somerset near Johnson	6	0.8	60.3	62.5	2.2
Winthrop – Loring Road near Court	7	1.0	64.4	65.7	1.3
Winthrop – Morton and Amelia	8	1.6	58.1	59.6	1.5
East Boston – Bayswater near Annavoy	9	1.3	65.6	67.3	1.7
East Boston – Bayswater near Shawsheen	10	1.3	60.4	55.2	(5.2)
East Boston – Selma and Orient	11	1.8	54.5	55.3	0.8
East Boston Yacht Club	12	1.2			
East Boston High School	13	1.9	59.9	62.0	2.1
East Boston – Jeffries Point Yacht Club	14	1.2	54.6	55.8	1.2
Chelsea – Admiral's Hill	15	2.8	58.3	60.8	2.5
Revere – Bradstreet and Sales	16	2.4	67.6	68.6	1.0
Revere – Carey Circle	17	5.3	58.7	60.2	1.5
Nahant – U.S.C.G. Recreational Facility	18	5.9	42.0	39.2	(2.8)
Swampscott – Smith Lane	19	8.7	39.8	42.0	2.2
Lynn – Pond and Towns Court	20	8.4	51.7	52.7	1.0
Everett – Tremont near Prescott	21	4.5	47.4	51.7	4.3
Medford – Magoun near Thatcher	22	6.0	48.5	52.2	3.7
Dorchester – Myrtlebank near Hilltop	23	6.3	55.0	55.6	0.6
Milton – Cunningham Park near Fullers	24	8.1	48.1	49.0	0.9
Quincy – Squaw Rock Park	25	4.2	39.7	42.7	3.0
Hull – Hull High School near Channel Street	26	6.0	56.9	58.3	1.4
Roxbury – Boston Latin Academy	27	5.3	53.4	54.4	1.0
Jamaica Plain – Southbourne Road	28	7.7	44.0	45.4	1.4
Mattapan – Lewenburg School	29	7.3	35.9	35.3	(0.6)
East Boston – Piers Park	30	1.5	47.4	63.7	16.3
Arithmetic Average			54.4	55.5	1.1

Source: HMMH.
Notes: Changes in ( ) represent a decrease in measured noise level.
Distance from Logan Airport calculated from the Airport Reference Point.
Site 12 is no longer operational.
Site 3 had interference from an outside source in 2013 and Site 30 in 2014
Sites 3, 12 and 30 are not included in the Average values.

Table 6-10 Measured Versus Modeled - Comparison of Measured DNL Values to RealContours™-modeled DNL Values, 2013 and 2014

Location	Site	Distance from Logan Airport (miles)	2013 Measured Aircraft – Only DNL	2013 Modeled RC Results INMv7.0d (DNL)[1]	2014 Measured Aircraft – Only DNL	2014 Modeled RC Results INMv7.0d (DNL)[1]	2013 Difference Modeled minus Measured	2014 Difference Modeled minus Measured
South End – Andrews Street	1	3.7	54.6	53.8	56.0	55.1	(0.8)	(0.9)
South Boston – B and Bolton	2	2.9	54.1	57.9	56.6	59.3	3.8	2.7
South Boston – Day Blvd. near Farragut	3	2.5	69.5	60.5	60.5	60.6	(9.0)	0.1
Winthrop – Bayview and Grandview	4	1.6	71.2	72.8	71.0	72.0	1.6	1.0
Winthrop – Harborview and Faun Bar	5	1.9	63.2	64.2	63.4	64.1	1.0	0.7
Winthrop – Somerset near Johnson	6	0.8	60.3	62.3	62.5	63.7	2.0	1.2
Winthrop – Loring Road near Court	7	1.0	64.4	68.5	65.7	71.8	4.1	6.1
Winthrop – Morton and Amelia	8	1.6	58.1	62.6	59.6	63.5	4.5	3.9
East Boston – Bayswater near Annavoy	9	1.3	65.6	70.7	67.3	72.2	5.1	4.9
East Boston – Bayswater near Shawsheen	10	1.3	60.4	62.6	55.2	65.1	2.2	9.9
East Boston – Selma and Orient[2]	11[2]	1.8	54.5	57.3	55.3	57.7	2.8	2.4
East Boston Yacht Club	12	1.2		68.1		69.6		
East Boston High School	13	1.9	59.9	60.0	62.0	62.0	0.1	0.0
East Boston – Jeffries Point Yacht Club	14	1.2	54.6	56.1	55.8	56.8	1.5	1.0
Chelsea – Admiral's Hill	15	2.8	58.3	58.8	60.8	61.2	0.5	0.4
Revere – Bradstreet and Sales	16	2.4	67.6	67.6	68.6	68.9	0.0	0.3
Revere – Carey Circle	17	5.3	58.7	59.6	60.2	60.6	0.9	0.4
Nahant – U.S.C.G. Recreational Facility	18	5.9	42.0	44.6	39.2	45.7	2.6	6.5
Swampscott – Smith Lane	19	8.7	39.8	44.9	42.0	46.3	5.1	4.3
Lynn – Pond and Towns Court	20	8.4	51.7	53.6	52.7	54.7	1.9	2.0
Everett – Tremont near Prescott	21	4.5	47.4	51.7	51.7	54.4	4.3	2.7
Medford – Magoun near Thatcher	22	6.0	48.5	50.8	52.2	53.4	2.3	1.2
Dorchester – Myrtlebank near Hilltop	23	6.3	55	54.2	55.6	54.3	(0.8)	(1.3)
Milton – Cunningham Park near Fullers	24	8.1	48.1	54.0	49.0	54.5	5.9	5.5
Quincy – Squaw Rock Park	25	4.2	39.7	47.7	42.7	47.8	8.0	5.1
Hull – Hull High School near Channel Street	26	6.0	56.9	58.1	58.3	58.6	1.2	0.3
Roxbury – Boston Latin Academy	27	5.3	53.4	52.9	54.4	54.3	(0.5)	(0.1)
Jamaica Plain – Southbourne Road	28	7.7	44	49.1	45.4	50.5	5.1	5.1
Mattapan – Lewenburg School	29	7.3	35.9	46.6	35.3	47.6	10.7	12.3
East Boston – Piers Park	30	1.5	47.4	53.5	63.7	54.3	6.1	(9.4)
Arithmetic Average [3]			54.4	57.1	55.5	58.4	2.8	2.9

Source: HMMH.
Note: 2013 and 2014 Modeled results were computed for the whole year.
Distance from Logan Airport calculated from the Airport Reference Point.
NA = Not available.
1 INMv7.0d with adjusted database. (Database modifications as described in the *Logan Airport 1994/1995 Generic Environmental Impact Report).*
2 Includes FAA-approved terrain adjustment modifying normal INMv7.0d result for Site 11.
3 Sites 3, 12 and 30 are not included in the average values.

Supplemental Metrics

To further describe the noise environment, this *2014 EDR* includes supplemental noise metrics: CNI, dwell and persistence, and times above a noise threshold.

Cumulative Noise Index (CNI)

Massport reports total annual fleet noise at Logan Airport, as defined in the Logan Airport Noise Rules by a metric referred to as the CNI. The CNI is a single number representing the sum of the entire set of single-event noise energy from each operation experienced at Logan Airport over a full year of operation. The CNI is weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each event. This penalty is equivalent to multiplying the number of nighttime events of each aircraft by a factor of 10.

The Logan Airport Noise Rules define CNI in units of EPNdB[24] and require that the index be computed for the fleet of commercial aircraft operating at Logan Airport throughout the year. In addition, in EDRs and ESPRs, Massport reports partial CNI values of noise at Logan Airport, so that various subsets of the fleet (cargo, night operations, passenger jets, etc.) are identified. Utilizing the expanded data available from the NOMS, all of the available aircraft registration data were used to select the proper noise certification levels from the latest aircraft noise registration database.[25]

The Noise Rules, adopted by Massport following public hearings held in February 1986, established a CNI limit of 156.5 EPNdB. The CNI generally has decreased since 1990, remaining below that cap, and typical changes from one year to the next have been within a few tenths of a dB. The CNI has increased slightly each year since 2010 primarily due to increases in commercial operations or night operations. In 2014, the CNI increased to 152.9 EPNdB representing a 0.6dB change from 2013, but remained well below the cap of 156.5 EPNdB. The partial CNI decreased in four categories and increased in 14 categories for 2014 when compared to 2013.

Partial Cumulative Noise Index Calculations

Partial CNI values were obtained by summing the noise from particular segments of Logan Airport's total operations. They are useful for identifying the greatest contributors to overall noise. As shown in Table 6-11, the sectors of the fleet with the highest numbers of partial CNI indicate a greater contribution to total noise. Table 6-11 also indicates that for 2014:

- The passenger jets' contribution increased in 2014 due to increased operations; and
- The overall nighttime CNI contribution continued to increase compared with daytime due to an increase in nighttime passenger operations.

24 EPNdB is the noise metric used to certify aircraft by the FAA.
25 Type-certificate data sheet for noise database available from the European Aviation Safety Agency; //easa.europa.eu/certification/type-certificates/noise.php.

Table 6-11 Cumulative Noise Index (EPNdB)[1]

	Logan Airport CNI Cap – 156.5 EPNdB							
	1990	2000	2010	2011	2012	2013	2014	Change (2013-2014)
Full CNI (Entire Commercial Jet Fleet)	**156.4**	**154.7**	**151.9**	**152.1**	**152.2**	**152.3**	**152.9**	**0.6**
Total Passenger Jets	155.2	153.6	150.9	150.6	151.3	151.4	152.2	0.8
Total Cargo Jets	150.1	148.2	145.1	146.7	144.9	145.1	144.5	(0.6)
Total Daytime	152.5	149.5	146.8	146.9	147.0	147.0	147.5	0.5
Total Nighttime	154.4	153.1	150.3	150.6	150.6	150.8	151.3	0.5
Total Stage 2 Jets	NA	124.7	113.6	110.8	104.9[2]	111.3[3]	NA	NA
Total Stage 3 Jets	NA	154.7	151.9	152.1	152.2	152.3	152.9	0.6
Daytime Stage 2	NA	122.6	103.6	NA	104.9	101.4	NA	NA
Nighttime Stage 2	NA	120.5	113.1	110.8	NA	110.8	NA	NA
Daytime Stage 3	NA	149.5	146.8	146.9	147.0	147.0	147.5	0.5
Nighttime Stage 3	NA	153.1	150.3	150.6	150.6	150.8	151.3	0.5
Passenger Jet Stage 2	NA	124.2	NA	NA	104.9[2]	101.4	NA	NA
Passenger Jet Stage 3	NA	153.6	150.9	150.6	151.3	151.4	152.2	0.8
Cargo Jet Stage 2	NA	114.8	113.6	110.8	NA	110.8	NA	NA
Cargo Jet Stage 3	NA	148.2	145.1	146.7	144.9	145.1	144.5	(0.6)
Daytime Passenger	NA	149.3	146.6	146.5	146.8	146.8	147.3	0.5
Nighttime Passenger	NA	151.6	149.0	148.5	149.4	149.6	150.5	0.9
Daytime Cargo	137.1	137.5	134.5	136.6	134.0	133.6	134.9	1.3
Nighttime Cargo	149.9	147.8	144.7	146.3	144.5	144.8	144.0	(0.8)
Daytime Passenger Stage 2	NA	122.3	NA	NA	104.9[2]	101.4	NA	NA
Daytime Passenger Stage 3	NA	149.2	146.6	146.5	146.8	146.8	147.3	0.5
Nighttime Passenger Stage 2	NA	119.8	NA	NA	NA	NA	NA	NA
Nighttime Passenger Stage 3	NA	151.6	149.0	148.5	149.4	149.6	150.5	0.9
Daytime Cargo Stage 2	NA	111.1	103.6	NA	NA	NA	NA	NA
Daytime Cargo Stage 3	NA	137.5	134.4	136.6	134.0	133.6	134.9	1.3
Nighttime Cargo Stage 2	NA	112.3	113.1	110.8	NA	110.8	NA	NA
Nighttime Cargo Stage 3	NA	147.8	144.7	146.3	144.5	144.8	144.0	(0.8)

Source: HMMH 2014.
Notes: General aviation and non-jet aircraft are not included in the calculation.
NA = Not available.
1 Data for years prior to 2010 are available in *Appendix H, Noise Abatement*.
2 The Stage 2 results are from a Falcon 20 aircraft arrival and departure flown by a Charter Operator during 2012.
3 The Stage 2 results during 2013 are from a GII-B aircraft flown by a Charter Operator and a LEAR 25 flown by a Cargo Operator.

Table 6-12 provides the number of flight operations, the resulting CNI by airline for 2013 and 2014, and the partial CNI per operation for 2013, and 2014. The table shows the relative contribution of each airline to total CNI and reflects the contributions of individual aircraft noise levels and the frequency with which they occur. The table is sorted by the partial CNI by operation for 2014 and shows the major cargo operators at the top of this list, since they operate primarily at night. JetBlue Airways, with the largest number of operations, has the second highest CNI per airline at 145.9 in 2013 and 145.7 in 2014, but its partial CNI by operation is well below the other major airlines in part due to its use of newer, quieter aircraft. Federal Express has less than one tenth of the operations that JetBlue Airways has but its total CNI per airline is 143.8 in 2013 and 143.2 in 2014, or only less than two below JetBlue Airways. The partial CNI by operation for FedEx is the highest of all airlines due to their use of older DC10 and MD11 aircraft. These are the primary aircraft in the FedEx fleet and account for half of their nighttime operations. The noisier signatures of these aircraft combined with the 10 dB nighttime DNL penalty results in the proportionally larger FedEx contribution to the CNI.

Regional carriers generally contribute the least to the partial CNI per operation whereas the international carriers, which operate larger aircraft and generally have more operations at night, are just below the cargo operators in rank. The relative positions for the domestic carriers are due mainly to their fleet characteristics and number of night operations. United Airlines has similar number of operations to Delta Air Lines and much fewer than JetBlue Airways; however, 22.5 percent of its operations are at night as compared to JetBlue Airways, which had only 14.4 percent at night. Delta Air Lines only has 12.7 percent of its operations at night but it flies an older fleet consisting of MD-80s and Boeing 767s.

Table 6-12 Annual Operations and Partial CNI by Airline and per Operation, 2013 and 2014

Airlines with more than 100 flights in 2014	2013 Operations[1]	2013 Total Airline CNI (EPNdB)	2014 Operations[1]	2014 Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation 2012	2013	2014	Airline Category
FedEx	3,049	143.8	3,315	143.2	109.0	109.0	108.0	Cargo
United Parcel Service	1,408	137.4	1,435	137.5	105.8	106.0	105.9	Cargo
Atlas Air	205	130.9	489	132.7	N/A	107.8	105.8	Cargo
British Airways	2,576	137.3	2,678	138.2	104.8	103.2	104.0	International
Air France	960	131.1	899	131.8	104.8	101.2	102.3	International
Turkish Airlines	N/A	N/A	452	128.8	N/A	N/A	102.3	International
Lufthansa	1,725	132.6	1,714	134.1	100.6	100.2	101.8	International
Emirates Airlines	N/A	N/A	1,190	132.4	N/A	N/A	101.7	International
Virgin Atlantic	1,066	127.5	716	129.5	97.7	97.2	100.9	International
Alitalia	542	125.3	550	128.1	96.9	97.9	100.7	International
Swiss Air	720	128.0	722	128.7	98.7	99.5	100.2	International
SATA International	468	126.4	533	127.3	100.3	99.7	100.1	International
United Airlines	25,239	142.8	34,609	144.7	98.8	98.8	99.3	Domestic
American Airlines	22,984	141.7	22,626	142.3	97.8	98.1	98.8	Domestic
Southwest Airlines	15,937	140.6	18,525	141.5	98.2	98.6	98.8	Domestic
Alaska Airlines	2,661	132.1	6,180	136.3	98.0	97.8	98.4	Domestic
Iberia Air Lines Spain	404	123.1	332	123.3	97.0	96.8	98.1	International

Table 6-12 Annual Operations and Partial CNI by Airline and per Operation, 2013 and 2014 (Continued)

Airlines with more than 100 flights in 2014	2013 Operations[1]	2013 Total Airline CNI (EPNdB)	2014 Operations[1]	2014 Total Airline CNI (EPNdB)	Partial CNI (EPNdB) per Operation 2012	2013	2014	Airline Category
People Express	N/A	N/A	170	120.1	N/A	N/A	97.8	Domestic
Spirit Airlines	2,721	132.3	2,945	132.3	97.4	97.4	97.6	Domestic
Delta Air Lines	24,011	141	29,557	141.7	96.8	96.6	97	Domestic
Japan Airlines	646	125.1	731	125.6	N/A	96.9	97	International
Virgin America	6720	134.9	3198	132.0	97.8	98.6	97	Domestic
Hainan Airlines Co. Ltd.	N/A	N/A	280	121.5	N/A	N/A	97.0	International
Aer Lingus	1,513	129.1	2,964	131.5	97.1	97.0	96.7	International
JetBlue Airways	79,512	145.9	82,595	145.7	96.9	97.1	96.6	Domestic
Air Canada	1,748	126.8	1,112	126.6	95.3	95.1	96.1	International
TACV-Cabo Verde	214	124.5	186	118.7	102.3	100.7	96	International
US Airways	35,806	141.1	35,993	141.3	95.8	95.4	95.7	Domestic
Shuttle America Corp	12,047	135.4	9,751	134.3	94.8	93.7	94.4	Regional
Sun Country Airlines	943	124.2	1027	124.3	95.1	93.8	94.2	Regional
GoJet Airlines	N/A	N/A	476	120.8	N/A	N/A	94	Domestic
AirTran Airways	7764	133.3	3442	129.2	94.7	94.4	93.9	Domestic
Sky Regional Airlines Inc.	N/A	N/A	3,981	129.5	N/A	N/A	93.5	International
Copa Airlines	347	119	730	122.0	N/A	N/A	93.3	International
SkyWest Airlines	469	118.9	1152	123.8	N/A	N/A	93.2	Domestic
Pinnacle Airlines	5,829	129.7	7,310	131.7	89.4	91.9	93.1	Regional
Icelandair	1,120	123.9	1,227	124.0	93.4	93.0	93.1	International
Mesa Airlines	886	119.4	1,404	124.3	95.3	93.3	92.9	Regional
US Airways Express/Republic	3,250	127.5	3290	127.5	93.2	92.8	92.4	Regional
AWAC - US Air Express	6,440	129.9	6,165	129.9	91.4	91.4	92	Regional
Delta Connection/Atlantic SE	4744	128.3	6965	129.7	91.6	91.5	91.3	Domestic
Chautauqua	3,387	125.9	1,870	122.6	90.2	91.9	89.9	Regional
Air Canada Jazz	5,131	126.8	14,353	131.3	90.2	89.9	89.8	International
Trans States Airlines	181	114.2	160	111.8	90.3	89.8	89.8	Regional

Source: HMMH, Massport. 2015.
Notes: NA = Airline had no operations at Logan Airport.
1 Operations for some carriers differ to those in *Chapter 2, Activity Levels* and *Chapter 7, Air Quality/Emissions Reduction* because this table only includes jet aircraft and not turboprops, and because it includes both scheduled and unscheduled air carriers.

Dwell and Persistence Reduction Goals

Another supplemental measure of noise impact relates to the length of time noise impacts occur. To provide temporary relief to neighborhoods affected by regular overflights during single or multi-day periods, the PRAS Advisory Committee established two short-term goals for the system in addition to the annual goals:

- Provide relief from excessive dwell. Exceedance is defined as more than seven hours of operations over a given area during any day between the hours of 7:00 AM and midnight.
- Provide relief from excessive persistence. Exceedance is defined as more than 23 hours of operations over an area between 7:00 AM and midnight during a period of three consecutive days.

In contrast to the annual goals that count the number of equivalent operations on a runway, dwell and persistence are measured by the number of hours that a given location or area is subject to jet aircraft overflights. The PRAS Advisory Committee designated eight runway end combinations for computing the effects of dwell and persistence on the communities, as shown in Table 6-13.

Table 6-13 Representative Neighborhoods near Logan Airport Affected by Runway Use

Runway	Representative Affected Neighborhoods
4L and 4R Arrivals	South Boston (Farragut St.), Dorchester, Quincy, Milton, Weymouth, and Braintree
32 and 33L Arrivals	Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
14 and 15R Departures	Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
22L and 22R Departures	South Boston (Farragut Street), Boston Harbor, Hull, Cohasset, Hingham, Scituate, and other South Shore locations
27 Departures	South Boston (Fan Pier), Roxbury, Jamaica Plain, South End, West Roxbury, Roslindale, Brookline, Hyde Park, and other points South and West
4L and 4R Departures plus 22L and 22R Arrivals	East Boston (Bayswater, Orient Heights), Winthrop (Court Road), Revere, and Nahant
9 Departures plus 27 Arrivals	Winthrop (Point Shirley), Boston Harbor, and other points North
33 Departures plus 15 Arrivals	East Boston (Eagle Hill), Chelsea, Everett, Medford, Somerville, Arlington, Cambridge, and other points South and West

Source: Massport.

As required by Massport's commitments for the Logan Airside Improvements Planning Project,[26] this *2014 EDR* reports on noise dwell and persistence levels. Higher levels of dwell or persistence for overwater areas represent a benefit since this produces a corresponding decrease in total hours over populated areas. Figures 6-13 and 6-14 illustrate the annual hours of dwell and persistence by runway end for 2009 through 2014. The RSA construction which altered annual runway use during 2011 and 2012 is evident in the figures as those two years are lower in the arrivals to Runway 15R and departures from Runway 33L runway end and higher in most of the remaining runway ends. Use of the runways returned to pre-construction levels in 2013. In 2013 and 2014, the largest contributor to dwell and persistence remained arrivals to Runway 27 and departures from Runway 9; persistence and dwell both increased in 2014 compared to 2013. This was due to the higher use of Runway 9 for departures during 2014. Dwell and persistence has substantially increased for Runway 15R arrivals and Runway 33L departures and also for Runways 32 and 33L arrivals in 2014.

26 *Logan Airside Improvements Planning Project Final EIS*, Section 4.2.3 PRAS Monitoring and Reporting June 2002.

Figure 6-13 Comparison of Annual Hours of Dwell Exceedance by Runway End, 2010 to 2014

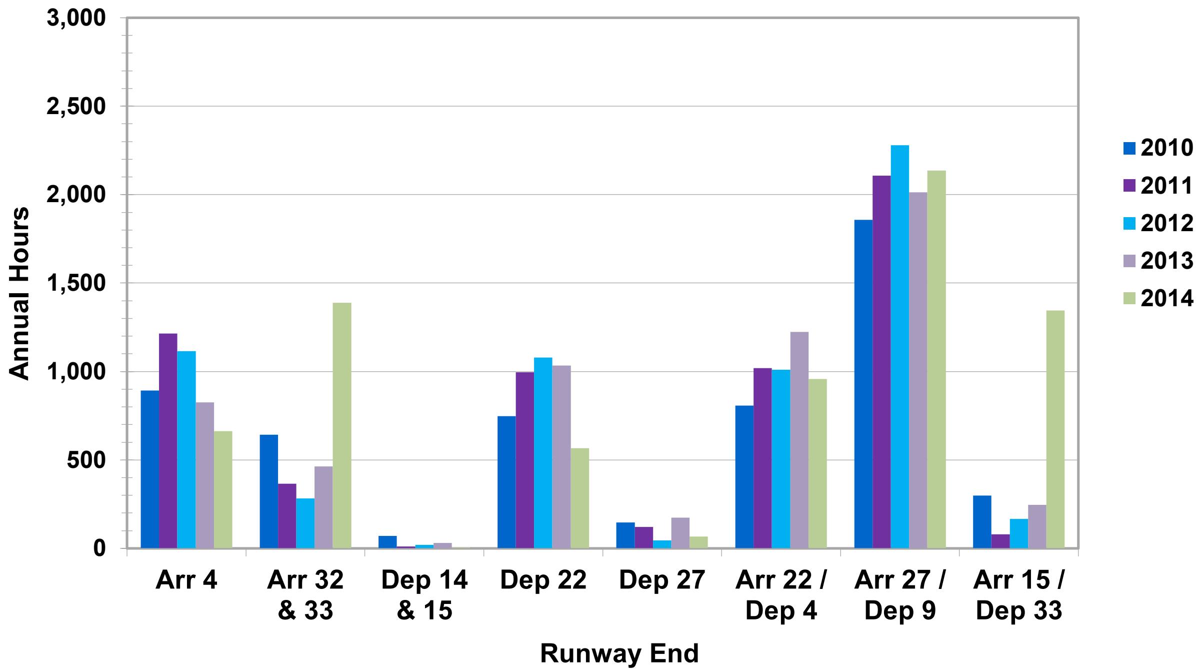
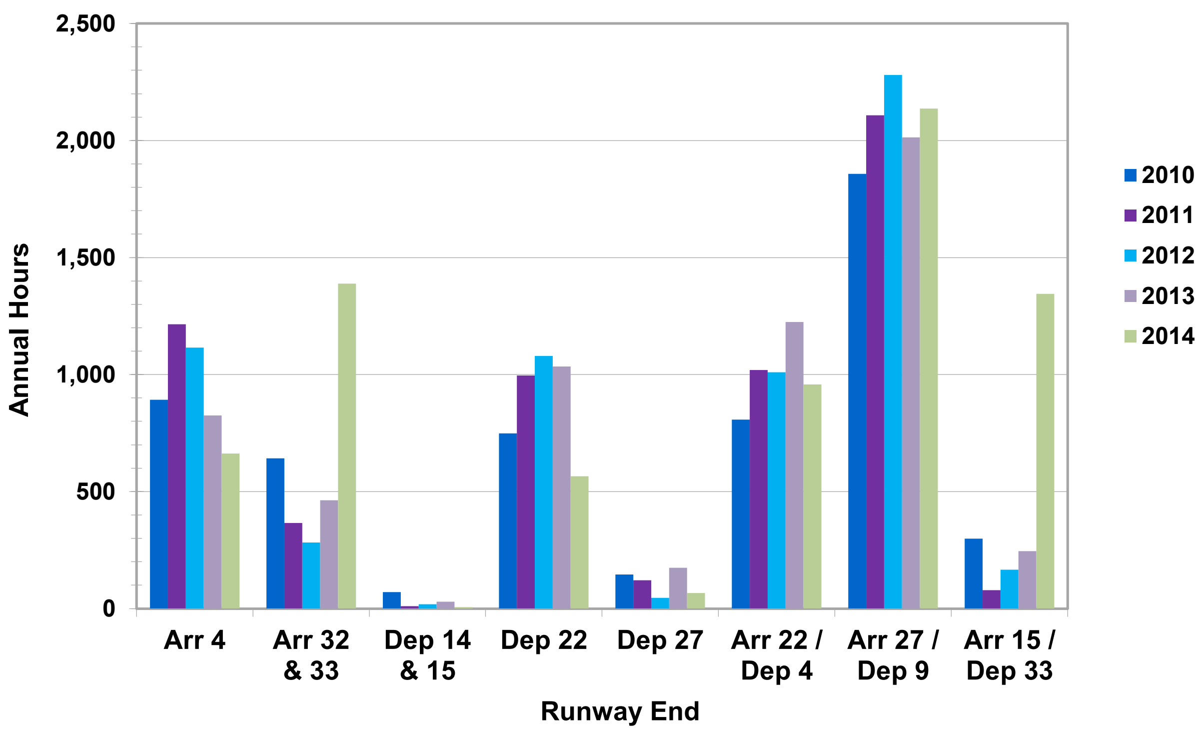


Figure 6-14 Comparison of Annual Hours of Persistence Exceedance by Runway End, 2010 to 2014



Time Above (TA)

The third supplemental noise metric reported in this *2014 EDR* is the amount of time that aircraft noise is above each of three predefined threshold sound levels. The measure is referred to generally as TA, and the threshold sound levels used in the analysis are 65, 75, and 85 dBA (A-weighted dBs). Like DNL values, these times are computed using the FAA-approved INM as modified for Logan Airport. The calculations are made at each of Massport's permanent noise monitoring locations and are based on an average 24-hour day during the year as well as for the average nine-hour nighttime period from 10:00 PM to 7:00 AM. The threshold sound levels of 65, 75, and 85 dBA reflect different degrees of speech interference depending on factors such as whether people are outdoors, indoors with their windows open, or indoors with windows closed. Findings for 2014 include:

- The TA results at many of the sites correspond to the change in the contour levels. At Site 2, which is affected by Runway 27 departures, the 24-hour TA65 level increased from 18.1 minutes in 2013 to 20.4 minutes in 2014. This is consistent with the higher use of Runway 27 during 2014.
- At Site 13 (East Boston High School), TA values increased from 22.7 minutes in 2013 to 32.2 minutes in 2014 reflecting the increased use of Runway 15R-33L in 2014.

Tables 6-14 and 6-15 present a summary of the calculated TA values for 2013 and 2014.

Table 6-14 Time Above (TA) dBA Thresholds in a 24 Hour Period for Average Day[1]

Location	Site	Distance from Logan Airport (miles)	Minutes above Threshold 2013			Minutes above Threshold 2014			Modeled Day-Night Sound Levels	
			85 dBA	75 dBA	65 dBA	85 dBA	75 dBA	65 dBA	2013[2]	2014[2]
Winthrop – Bayview and Grandview	4	1.6	13.1	43.5	92.0	10.5	36.8	79.3	72.8	72.0
Winthrop – Harborview and Faun Bar	5	1.9	0.2	14.7	81.8	0.2	14.6	71.8	64.2	64.1
Winthrop – Somerset near Johnson	6	0.8	0.0	3.7	96.4	0.1	4.1	99.5	62.3	63.7
Winthrop – Loring Road near Court	7	1.0	2.5	26.7	154.5	2.4	24.2	149.1	68.5	71.8
Winthrop – Morton and Amelia	8	1.6	0.0	3.7	60.5	0.0	3.9	61.8	62.6	63.5
East Boston – Bayswater near Annavoy	9	1.3	1.7	25.2	74.1	2.2	29.6	82.9	70.7	72.2
East Boston – Bayswater near Shawsheen	10	1.3	0.2	6.2	42.8	0.3	6.6	50.5	62.6	65.1
East Boston – Selma and Orient	11	1.8	0.0	0.9	9.1	0.0	0.9	10.0	57.3	57.7
East Boston Yacht Club	12	1.2	1.0	38.6	171.5	1.3	34.8	156.6	68.1	69.6
East Boston High School	13	1.9	0.1	5.0	22.7	0.1	7.4	32.2	60.0	62.0
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.5	10.2	0.0	0.7	11.0	56.1	56.8
East Boston – Piers Park	30	1.5	0.0	0.3	4.6	0.0	0.3	5.1	53.5	54.3
Chelsea – Admiral's Hill	15	2.8	0.1	3.8	20.1	0.1	6.3	29.6	58.8	61.2
Revere – Bradstreet and Sales	16	2.4	1.6	14.2	35.1	2.5	19.7	47.6	67.6	68.9
Revere – Carey Circle	17	5.3	0.0	1.2	26.6	0.0	1.5	36.7	59.6	60.6
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.3	0.0	0.0	0.3	44.6	45.7
Everett – Tremont near Prescott	21	4.5	0.0	0.2	7.2	0.0	0.4	11.9	51.7	54.4
Medford – Magoun near Thatcher	22	6.0	0.0	0.1	6.1	0.0	0.2	10.0	50.8	53.4
Swampscott – Smith Lane	19	8.7	0.0	0.0	0.9	0.0	0.0	1.1	44.9	46.3
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	7.6	0.0	0.0	11.5	53.6	54.7
South End – Andrews Street	1	3.7	0.0	0.3	10.9	0.0	0.4	12.6	53.8	55.1
South Boston – B and Bolton	2	2.9	0.0	2.5	18.1	0.0	3.4	20.4	57.9	59.3
South Boston – Day Blvd. near Farragut	3	2.5	0.1	4.1	54.1	0.0	3.8	53.1	60.5	60.6
Roxbury – Boston Latin Academy	27	5.3	0.0	0.2	9.5	0.0	0.2	11.4	52.9	54.3
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	3.1	0.0	0.0	4.2	49.1	50.5
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.7	0.0	0.0	0.8	46.6	47.6
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	12.8	0.0	0.0	12.7	54.2	54.3
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	13.2	0.0	0.0	15.4	54.0	54.5
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.6	0.0	0.0	0.4	47.7	47.8
Hull – Hull High School near Channel Street	26	6.0	0.0	0.3	25.8	0.0	0.3	26.3	58.1	58.6
Average TA Value			0.7	6.5	35.8	0.7	6.7	37.2	63.4	64.5

Source: HMMH 2015.
Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA = A-weighted decibel
1 Modeled using RealContoursTM and RealProfilesTM using INM (v7.0d).
2 INMv7.0d for all of 2013 and 2014 (12 months) with adjusted database. (Database modifications as described in the Logan Airport *2004 ESPR*).

Table 6-15 Time Above (TA) dBA Thresholds in a Nine Hour Night Period for Average Day[1]

Location	Site	Distance from Logan Airport (miles)	Minutes above Threshold During the Night 2013			Minutes above Threshold During the Night 2014			Modeled Day-Night Sound Levels	
			75 dBA	65 dBA	65 dBA	85 dBA	75 dBA	65 dBA	2013[2]	2014[2]
Winthrop – Bayview and Grandview	4	1.6	1.2	3.8	8.4	1.0	3.3	7.5	72.8	72.0
Winthrop – Harborview and Faun Bar	5	1.9	0.0	1.4	7.4	0.0	1.4	6.6	64.2	64.1
Winthrop – Somerset near Johnson	6	0.8	0.0	0.6	13.0	0.1	1.3	17.5	62.3	63.7
Winthrop – Loring Road near Court	7	1.0	0.3	3.1	20.9	0.6	4.5	25.9	68.5	71.8
Winthrop – Morton and Amelia	8	1.6	0.0	0.5	9.3	0.1	0.9	12.2	62.6	63.5
East Boston – Bayswater near Annavoy	9	1.3	0.3	4.5	13.7	0.5	5.9	16.8	70.7	72.2
East Boston – Bayswater near Shawsheen	10	1.3	0.0	0.5	8.5	0.1	1.3	11.0	62.6	65.1
East Boston – Selma and Orient	11	1.8	0.0	0.0	0.5	0.0	0.0	1.0	57.3	57.7
East Boston Yacht Club	12	1.2	0.2	5.6	25.2	0.6	6.9	27.8	68.1	69.6
East Boston High School	13	1.9	0.0	0.6	2.7	0.0	1.0	3.9	60.0	62.0
East Boston – Jeffries Point Yacht Club	14	1.2	0.0	0.0	1.2	0.0	0.0	1.7	56.1	56.8
East Boston – Piers Park	30	1.5	0.0	0.0	0.4	0.0	0.0	0.6	53.5	54.3
Chelsea – Admiral's Hill	15	2.8	0.0	0.5	2.4	0.0	0.9	3.7	58.8	61.2
Revere – Bradstreet and Sales	16	2.4	0.4	3.4	7.9	0.6	4.2	9.8	67.6	68.9
Revere – Carey Circle	17	5.3	0.0	0.2	6.4	0.0	0.3	8.0	59.6	60.6
Nahant – U.S.C.G. Recreational Facility	18	5.9	0.0	0.0	0.0	0.0	0.0	0.1	44.6	45.7
Everett – Tremont near Prescott	21	4.5	0.0	0.0	0.8	0.0	0.1	1.8	51.7	54.4
Medford – Magoun near Thatcher	22	6.0	0.0	0.0	0.7	0.0	0.0	1.3	50.8	53.4
Swampscott – Smith Lane	19	8.7	0.0	0.0	0.1	0.0	0.0	0.2	44.9	46.3
Lynn - Pond and Towns Court	20	8.4	0.0	0.0	2.2	0.0	0.0	2.8	53.6	54.7
South End – Andrews Street	1	3.7	0.0	0.0	1.7	0.0	0.1	2.3	53.8	55.1
South Boston – B and Bolton	2	2.9	0.0	0.4	2.6	0.0	0.7	3.5	57.9	59.3
South Boston – Day Blvd. near Farragut	3	2.5	0.0	0.2	5.3	0.0	0.2	6.1	60.5	60.6
Roxbury – Boston Latin Academy	27	5.3	0.0	0.0	1.4	0.0	0.1	2.1	52.9	54.3
Jamaica Plain - Southbourne Road	28	7.7	0.0	0.0	0.5	0.0	0.0	0.8	49.1	50.5
Mattapan – Lewenburg School	29	7.3	0.0	0.0	0.0	0.0	0.0	0.1	46.6	47.6
Dorchester – Myrtlebank near Hilltop	23	6.3	0.0	0.0	1.3	0.0	0.0	1.4	54.2	54.3
Milton – Cunningham Park near Fullers	24	8.1	0.0	0.0	1.6	0.0	0.0	2.0	54.0	54.5
Quincy – Squaw Rock Park	25	4.2	0.0	0.0	0.0	0.0	0.0	0.0	47.7	47.8
Hull – Hull High School near Channel Street	26	6.0	0.0	0.1	5.1	0.0	0.1	6.2	58.1	58.6
Average TA Value			0.1	0.9	5.0	0.1	1.1	6.2	63.4	64.5

Source: HMMH 2015.
Notes: Distance from Logan Airport calculated from the Airport Reference Point.
dBA = A-weighted decibel
1 INMv7.0d for all of 2013 and 2014 (12 months) with adjusted database. (Database modifications as described in the *2004 ESPR*).
2 Modeled using RealContours™ and RealProfiles™ using INM v7.0d.

Noise Abatement

Massport's noise abatement program continues to play a critical role in helping to limit and monitor noise impacts. Massport's emphasis on noise abatement has focused on the benefits of better analysis tools and improved modeling techniques to identify the causes of noise problems. Massport also continues to coordinate with the FAA and the Logan Airport (CAC) on matters related to runway use and the on-going BLANS project.

Installed in 2008, the upgraded NOMS system includes vastly improved analysis and mapping capabilities, better quality flight tracking data, use of multilateration radar (a separate and unique source of operational data), and direct correlation of noise events with radar flight paths and complaints (a feature that the prior system did not have). This latter capability has improved the ability of the system to differentiate between aircraft and community noise sources. All measured data and complaint information in this report were generated through the new NOMS.

Other continuing elements of Massport's noise mitigation program are discussed below.

- The Massport Noise Abatement Office, which was initiated in 1977. The Noise Office also maintains the noise section of the Massport website.[27] The site provides information on Massport's sound insulation program, the Airport's noise monitoring system, various abatement measures, and other information of interest to the public.
- Preferred runway use designed to optimize Boston Inner Harbor operations (especially during nighttime hours).
- One of the most extensive residential and school sound insulation programs in the nation. To date, Massport has installed sound insulation in 5,467 residences, including 11,515 dwelling units, and 36 schools in East Boston, Roxbury, Dorchester, Winthrop, Revere, Chelsea, and South Boston.
- Historically, the percentage of eligible homeowners who have responded and whose dwellings are ultimately treated varies significantly by community from a high of nearly 90 percent in Revere to a low of about 50 percent in South Boston. Eighty to 85 percent of homeowners in East Boston and Winthrop have historically participated. Approximately 8 percent of applicants also choose the Room-of-Preference option that allows the owner to identify a room (usually a bedroom or living room) for extra acoustical treatment.
- The Massport RSIP program is almost complete within all areas currently eligible; if the DNL contour expands into untreated areas Massport would apply to the FAA for funds to sound insulate these areas.
- Development of annual noise contours (Figure 6-11 compares the DNL 65 dB contours for 2013 and 2014).
- A website that features an internet flight tracking system known as PublicVue. (http://www.massport.com/environment/environmental-reporting/noise-abatement/flight-monitor/). The PublicVue site allows the user to view flight tracks in near-real time, replay flight tracks, and enter noise complaints.

27 www.massport.com/environment/environmental_reporting/Noise%20Abatement/overview.aspx.

- Summary reports of operations by airline, runway, aircraft type, and other parameters that help the Noise Office track potential changes in the noise environment. Tables 6-12 and 6-14 are examples of these reports.

- Where appropriate as part of the BLANS process, FAA designed (with Massport in an advisory role) RNAV procedures to avoid highly populated areas and the use of an overwater visual approach at night to keep aircraft offshore as much as possible.

Airline Fleet Improvements

Commercial air carrier and cargo operators are deploying the newest engine technology at Logan Airport. Table 6-16 summarizes each airline operator and the percentage of its fleet that were originally manufactured as Stage 3 or Stage 4 aircraft prior to 2013. For 2013 and 2014, the table reports the percent of the airlines' fleet which is Stage 3 or Stage 4 equivalent. All of the major U.S. airlines at Logan Airport are using a fleet which is composed of 100 percent originally manufactured Stage 3 or Stage 4 aircraft. All of the new carriers at Logan Airport in 2014 are utilizing Stage 4 equivalent aircraft.

Massport recently initiated terminal and airfield improvements designed to safely handle the next generation of larger and more efficient Group VI aircraft including the Airbus A380, the world's largest and quietest commercial aircraft. Use of these larger aircraft will help to continue the trend of carrying more passengers in fewer flights.

Table 6-16 Airline Operations (percent) in Original Stage 3 or Equivalent Stage 4 Aircraft[1] (2013 to 2014)

	Number of Flights		Percentage of Original Stage 3 and 4 Operations[2]			
Airlines with more than 100 flights	2013	2014	2013 Stage 3	2013 Stage 4 Equiv.	2014 Stage 3	2014 Stage 4 Equiv.
Jetblue Airways	79,512	82,595	0%	100%	0%	100%
US Airways	35,806	35,993	1%	99%	0%	100%
United Airlines	25,239	34,609	0%	100%	0%	100%
Delta Air Lines	24,011	29,557	10%	90%	13%	87%
American Airlines	22,984	22,626	0%	100%	0%	100%
Southwest Airlines	15,937	18,525	19%	81%	18%	82%
Air Canada Jazz	5,131	14,353	0%	100%	0%	100%
Shuttle America Corp	12,047	9,751	0%	100%	0%	100%
Pinnacle Airlines	5,829	7,310	0%	100%	0%	100%
Delta Connection/Atlantic SE	4,744	6,965	0%	100%	0%	100%
Alaska Airlines	2,661	6,180	0%	100%	0%	100%
AWAC - US Air Express	6,440	6,165	0%	100%	0%	100%
Sky Regional Airlines Inc	3,141	3,981	0%	100%	0%	100%
AirTran Airways	7,764	3,442	0%	100%	0%	100%
Federal Express	3,049	3,315	32%	68%	40%	60%
US Airways Express/Republic	3250	3,290	0%	100%	0%	100%
Virgin America	3,360	3,198	0%	100%	0%	100%
Aer Lingus	1,513	2,964	0%	100%	0%	100%
Spirit Airlines	2,721	2,945	0%	100%	0%	100%
British Airways	2,576	2,678	0%	100%	0%	100%
Chautauqua	3,387	1,870	0%	100%	0%	100%
Lufthansa	1,725	1,714	0%	100%	0%	100%
United Parcel Service	1,408	1,435	0%	100%	0%	100%
Mesa Airlines	886	1,404	0%	100%	0%	100%
Icelandair	1120	1,227	0%	100%	0%	100%
Emirates Airlines	NA	1,190	N/A	N/A	0%	100%
SkyWest Airlines	469	1152	0%	100%	0%	100%
Air Canada	1748	1112	0%	100%	0%	100%
Sun Country Airlines	943	1027	0%	100%	0%	100%
Air France	960	899	0%	100%	0%	100%
Japan Airlines	646	731	0%	100%	0%	100%
Copa Airlines	347	730	0%	100%	0%	100%
Swiss Air	720	722	0%	100%	0%	100%
Virgin Atlantic	712	716	0%	100%	0%	100%
Alitalia	542	550	0%	100%	0%	100%
SATA International Airlines	468	533	0%	100%	0%	100%
Atlas Air	205	489	100%	0%	100%	0%
GoJet Airlines	NA	476	N/A	N/A	0%	100%
Turkish Airlines	NA	452	N/A	N/A	0%	100%
Iberia Air Lines Of Spain	404	332	0%	100%	0%	100%
Hainan Airlines Co. Ltd.	NA	280	N/A	N/A	0%	100%
TACV-Cabo Verde	214	186	0%	100%	0%	100%
People Express	NA	170	N/A	N/A	100%	0%
Trans States Airlines	181	160	0%	100%	0%	100%
Delta Connection/Comair	0	0	N/A	N/A	N/A	N/A
Compass Airlines	0	0	N/A	N/A	N/A	N/A
DHL Airways	0	0	N/A	N/A	N/A	N/A
Frontier Airlines	0	0	N/A	N/A	N/A	N/A

Source: Massport, 2014.
NA Not Available
1 Operations for some carriers differ with those in Chapter 2, Activity Levels, and Chapter 7, Air Quality/Emissions Reduction because the table only includes jet aircraft, not turboprops, and it includes scheduled and unscheduled air carriers.
2 Original Stage 3 means originally manufactured as a certificated Stage 3 aircraft under FAR Part 36. Stage 4 equivalent means the aircraft is either certificated Stage 4 or certificated Stage 3 and meets Stage 4 requirements.

Noise Complaint Line

In 2014, Massport received 12,855 noise complaints from 82 communities, a substantial increase from 2013 which logged 6,809 noise complaints from 74 communities. The increase in complaints was associated with the changes in runway use in 2014, most notably due to the elimination of the nighttime noise abatement procedure for over half of the year, increasing traffic over residential neighborhoods, as well as concentrations of flight tracks due to FAA RNAV procedures.

Table 6-17 is a summary of noise complaints from the Massport Noise Abatement Office. The summary table presents the top ten communities for both 2013 and 2014 in terms of the number of complaints and number of callers. The communities listed below represent 86 percent of the complaints in 2013 and 82 percent of the complaints in 2014. All of the remaining communities are summed together into a single line above the Grand total. *Appendix H, Noise Abatement* has a full listing of the complaints by community.

Table 6-17 Noise Complaint Line Summary

	2013		2014		Change
Town	**Calls**	**Callers**	**Calls**	**Callers**	**(2013 to 2014)**
Belmont	605	65	1,658	116	1,053
Cambridge	266	33	585	71	319
East Boston	124	42	354	106	230
Hull	923	156	1,855	332	932
Hyde Park	189	6	50	16	(139)
Lynn	405	5	482	5	77
Medford	49	33	742	154	693
Milton	1,925	222	2,669	189	744
Nahant	17	9	109	20	92
Roxbury	74	5	113	9	39
Somerville	166	72	938	239	772
South Boston	438	22	67	26	(371)
Watertown	196	44	541	72	345
Weymouth	217	7	83	7	(134)
Winthrop	252	86	237	98	(15)
Total (Only for Towns listed above)	**5,846**	**807**	**10,483**	**1,460**	**4,637**
Total Complaints from Other Towns	**963**	**302**	**2,372**	**624**	**1,409**
Total Complaints for 2014	**6,809**	**1,109**	**12,855**	**2,084**	**6,046**

Source: Massport, 2014.
Note: The top ten communities for each year are listed above. The complete list of complaints is in *Appendix H, Noise Abatement*.

Boston Logan Airport Noise Study

The FAA's ROD approving construction of the unidirectional Runway 14-32 required that the FAA, Massport, and the Logan Airport CAC jointly undertake a study to determine whether changes to existing noise abatement flight track corridors might further reduce noise impacts. In addition, the Massachusetts Environmental Policy Act (MEPA) Certificate for the *Boston-Logan Airside Improvements Planning Environmental Impact Report (EIR)* directed Massport to work with the FAA and local communities on a review of the Logan Airport PRAS. FAA has been implementing RNAV procedures at airports across the country such as Phoenix and Minneapolis-St. Paul. The noise study was able to influence the design of these RNAV procedures for implementation at Logan Airport.

Phase 1

This FAA study is being conducted in multiple phases. Phase 1, which was known as the Boston Overflight Noise Study (BONS), was initiated in the winter of 2004 and was completed in fall of 2007. During Phase 1, 55 airspace and operational alternatives to reduce noise related to Logan Airport overflights were identified and screened for safety, operational, and noise benefits. Of the 55 alternatives, 13 measures were identified as potentially implementable in the near term. This phase was completed in 2007 and a National Environmental Policy Act (NEPA) Categorical Exclusion was issued by FAA in October 2007 for several flight path changes mostly along the northeast and southeast shores from the Airport.[28]

The conventional and radar vectored[29] changes which could be implemented without airspace changes were implemented in February 2008. RNAV and other changes began taking place in 2009 when FAA completed design of these procedures. RNAV procedures were published by FAA on October 22, 2009 and were implemented in 2010.

Eight new RNAV procedures were implemented by FAA in 2010 and 2011 for Runways 4R, 9, 15R, 22R and 22L. Under these procedures, aircraft immediately depart the Airport similar to existing procedures but then aircraft follow a precise path over Boston Harbor, then aircraft cross the shoreline and return back over land at a higher altitude than previous procedures. In 2013, Runways 27 and 33L were added to these procedures:

- Starting on 2/1/2010 all six RNAV procedures were in use from Runway 9;
- Starting on 5/3/2010 all six RNAV procedures were in use from Runway 4R;
- Starting on 11/18/2010 all six RNAV procedures were in use from Runways 15R, 22R, and 22L;
- Starting on 3/10/2011 all eight RNAV procedures were in use from Runways 4R, 9, 15R, 22R and 22L;
- Starting on 3/7/2013 all eight RNAV procedures were in use Runways 4R, 9, 15R, 22R, 22L, and 27; and
- Starting on 6/5/2013 all eight RNAV procedures were in use Runways 4R, 9, 15R, 22R, 22L, 27, and 33L.

On December 14, 2011, three new RNAV STARs were also implemented by FAA. These concentrate arrivals on routes leading into the Logan Airport's airspace and improve efficiency of arrivals. These have little effect on the noise environment close to the Airport and the DNL contours. However, usage of these procedures has increased since they were introduced and this increased usage is evident in the modeled flight track graphics.

28 FAA Documented Categorical Exclusion Record of Decision, October 16, 2007.
29 Radar vector is the heading issued to aircraft to provide guidance by radar.

The Runway 33L departure is the last RNAV to be implemented. FAA completed a separate Environmental Assessment (EA) in January 2013. The FAA issued a Finding of No Significant Impact/ Record of Decision (FONSI/ROD) for the Runway 33L RNAV SID Final EA on June 4, 2013. The FAA also committed to a six-month and 12-month post-implementation review of the RNAV procedure. The reviews were posted by the FAA in April 2014 and September 2014[30]. Both reviews concluded that the BOS Runway 33L RNAV SID is performing as designed with aircraft successfully flying within the confines of the procedure's design. All other major Logan Airport runways that are capable of accommodating RNAV procedures have been implemented by the FAA previously and are in operation today. Since the modeling is based on the radar data tracks, all of these changes as they have been implemented have been included in the EDR modeling for each year.

Implementation of several of these procedures has increased noise complaints in some towns surrounding Logan Airport; however, the procedures themselves have resulted in aircraft at higher altitudes and in more patterns that are concentrated over the communities.

Phase 2

Phase 2 of BLANS, which began in late 2007, included consideration of 53 proposed arrival, departure, and ground noise measures. After the first level of screening completed in 2009, 32 measures advanced to the next level of screening. Nine of these measures address ground noise issues, six are approach measures, and 11 address departure measures. The remaining measures address local air traffic issues such as helicopters and altitudes for VFR flights. The Level 2 screening was completed in 2011 and of the 32 measures, 10 were passed on to Level 3, five were determined as completed, and 17 were eliminated. The Level 3 analysis, which consists of noise modeling for each individual measure along with a change analysis against the future baseline, was completed in 2012. The Level 3 Screening Report was published by the FAA in December 2012. Two of the flight measures were modified resulting in 12 measures evaluated (two measures are related to ground movements and 10 are related to flight procedures). Of these measures, eight were recommended for implementation by the Logan CAC (the two ground movements and six flight procedures) and four flight procedures were rejected. The FAA and Massport reviewed the Logan Airport CAC recommendations and determined that the two ground measures would meet the criteria for implementation; however, the FAA determined that none of the flight procedures would meet the criteria for noise abatement under BLANS.

The two approved measures, with their status, are described below:[31]

- **Preferred Location for Run-ups away from Communities**. Massport has already tested this measure and identified a new location at the end of Runway 32 to be used when operationally feasible.
- **Holding Area for Delayed Departures**. Massport is prepared to commit to working with the FAA to seek approval and funding (subject to FAA operations/safety approval, environmental review, Massport capital budget process, availability of FAA funds) for construction of a hold pad to allow for short-term staging of aircraft at or near the midpoint of the airfield.

In addition, Massport and the FAA agreed to implement supplemental programmatic measures recommended by the Logan Airport CAC. One example is Massport's commitment to establish an airport/community noise advisory group (Massport CAC) that will meet on a regular basis to continue dialogue on airport related noise concerns.

30 http://www.faa.gov/air_traffic/environmental_issues/ared_documentation/#Performance_Based_Navigation_PBN.
31 BLANS Level Three Screening Analysis, FAA, December 2012, Page E-3.

Phase 3

Phase 3 began in August 2013 and is evaluating various runway use measures with the goal of developing a runway use program that can be implemented at Logan Airport to further reduce noise. The Logan CAC voted to abandon the PRAS in April 2012 with the goal of Phase 3 to look at runway use measures that can be successfully implemented. Massport will continue to report PRAS goals and information until a new program is in place.

In November of 2014, the FAA began the first of up to four runway use tests designed to change runway use during periods of the day to better distribute activity. This test recommends different runway configurations between 6:00 AM and 9:30 AM than the configurations used between 9:00 PM and midnight.

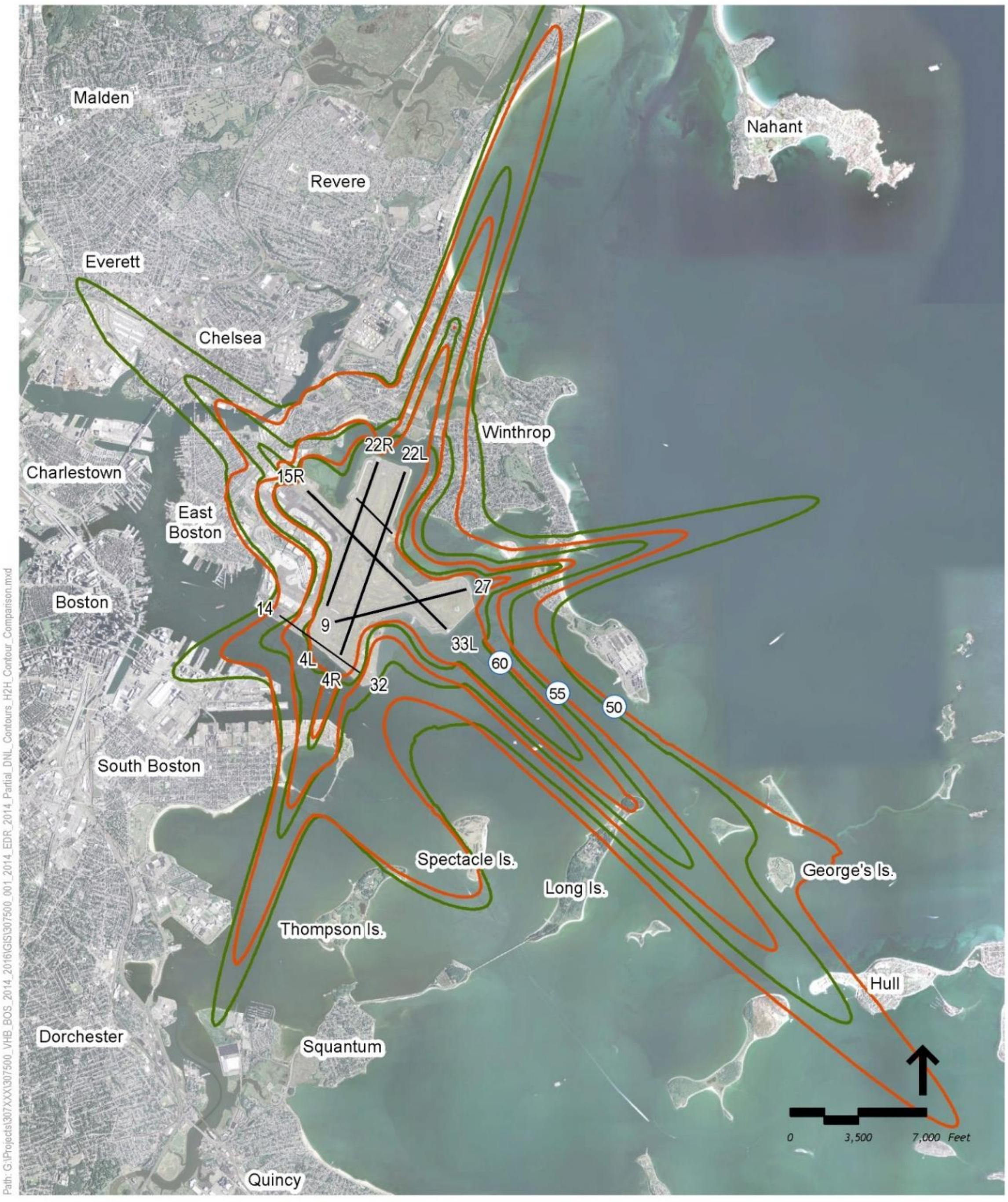
Head-to-Head Analysis

Due to safety concerns, at airports across the United States in June of 2014 the FAA halted the use of head-to-head operations or opposite direction operations, in which planes arrive on a runway in one direction and depart toward the opposite direction. When in use at Logan Airport, the procedure has aircraft departing from Runway 15R and landing on Runway 33L during the late night (typically midnight to 5:00 AM) when weather conditions are appropriate, including good visibility and little wind. At Logan Airport, head-to-head operations are an important part of the use of the late night noise abatement runway (Runway 15R-33L) since this keeps operations over Boston Harbor. Use of this procedure was restored in early 2015.

The head-to-head procedure has never been unavailable for such a long period before at Logan Airport. Massport used this opportunity to evaluate the effectiveness of the procedure during the overnight period. Using RealContours™ inputs developed for the *2014 EDR*, two contour comparisons were created to evaluate the noise effects with and without head-to-head operations in place for the June 17, 2014 to December 31, 2014 time period.

From the baseline case (without head-to-head operations) and adjusted case (with an estimate of head-to-head operations), partial DNL contours for the June 17, 2014 to December 31, 2014 conditions were modeled for the midnight to 6:00 AM time period. The fleet mix for both of these cases was kept the same and only the runway use was modified for the estimated head-to-head procedure. Figure 6-15 compares the partial DNL for these conditions. Note that the contour levels shown are partial DNL 50, 60, and 65 dB for this time period of the day only and do not directly compare to total annual DNL contours. Without the head-to-head procedure in place, the contours to the northwest from arrivals to Runway 15R and departures from Runway 33L are approximately 5 to 7 dB larger and the contours to the southeast out over the harbor from arrivals to Runway 33L and departures from Runway 15R are reduced by approximately 3 dB. Noise levels over other residential areas are approximately 1 to 2 dB greater also, specifically off the ends of Runways 9, 22L and 27, due to additional traffic.

Figure 6-15 Partial DNL Comparison Baseline (No Head-to-Head Operations) and Adjusted Case (With Head-to-Head Operations) 2014



Source: HMMH, MassGIS, USDA NAIP 2014

50-60 dB Partial DNL June 17 to December 31, 2014 midnight-6am Operations Using INM 7.0d

Estimated Partial DNL Contours with Head to Head Operations Allowed

Partial DNL Contours with Head to Head Operations Not Allowed

Reduced Engine Taxiing

Single or reduced engine taxiing has the potential to reduce noise at Logan Airport. When used, the largest benefit is achieved by reducing the use of the engines on the side of the aircraft closest to the community; however, this is not always practicable due to airline procedures, taxiway routings, and safety considerations. Massport has reached out to the airlines and encouraged the use of this procedure whenever practicable. The letter sent to airport users for 2014 from Massport is published in *Appendix L, Reduced/Single Engine Taxiing at Logan Airport Memorandum*.

In 2009, the Massachusetts Institute of Technology (MIT) in cooperation with Massport and FAA conducted a survey of pilots at Logan Airport and found that the procedure was widely used on arrivals but not frequently used on departures.[32] Key reasons cited for not using the procedure were safety-related or practical reasons such as a short taxi time. The survey indicated that for the procedure to be considered for arrivals, the taxi-in time would have to exceed 10 minutes and for departures, exceed 20 minutes. The average taxi-out times for Logan Airport for 2013 exceeded 20 minutes only during the 5:00 to 7:00 PM period and for 2014 only exceeded 20 minutes between the 7:00 to 8:00 AM and 5:00 to 6:00 PM periods. During 2013 and 2014, the average taxi-in time never exceeded 10 minutes. The total average departure taxi out time at Logan Airport for 2013 was 18.2 minutes and the average taxi-in time is 6.8 minutes (the total average taxi/delay time for 2013 is 12.6 minutes). The total average departure taxi out time at Logan Airport for 2014 increased to 18.3 minutes and the average taxi-in time decreased to 6.6 minutes (the total average taxi/delay time for 2014 is 12.5 minutes).[33] These small changes year to year occur due to several factors such as; changes in schedules, weather, and use of the runways. Mandatory single engine taxiing was also one of the proposed measures in the BLANS but was rejected by FAA due to safety concerns, and it is currently being implemented as a voluntary measure, when conditions are appropriate.

Noise Abatement Management Plan

Massport's noise abatement goals are achieved through the implementation of multiple elements. Table 6-18 lists these goals and the associated plan elements, and reports on progress toward achieving these goals.

32 The full report was published in the *2009 EDR* in *Appendix L, Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations.*
33 FAA Aviation System Performance Metrics: Avg. Taxi Time: Standard Report –accessed 06/30/2015.

Table 6-18 Noise Abatement Management Plan

Noise Abatement Goal	Plan Elements	2014 Progress Report
Limit total aircraft noise	Limit on Cumulative Noise Index (CNI)	The CNI value for 2014 was 152.9 EPNdB which is well below the cap of 156.5 EPNdB.
	Stage 3 percentage Requirement in Noise Rules	In 2014, Stage 3 operations represented 100 percent of Logan Airport's total commercial jet traffic.
Mitigate noise impacts	Residential Sound Insulation Program (RSIP)	106 dwelling units were sound insulated in 2014, bringing the total of treated dwelling units to 11,515 since the start of the program in 1986. See *Appendix H, Noise Abatement* for additional details.
	School Sound Insulation Program	36 eligible schools have been sound insulated since this program began.
	Noise Abatement Arrival and Departure Procedures	Flight track monitoring and data analysis were used to verify adherence to noise abatement flight procedures. See *Appendix H, Noise Abatement* for copies of the 2013 and 2014 Monitoring Report.
	Preferential Runway Advisory System (PRAS) Runway End Use Goals	The PRAS computer system was last used early in 2004 but due to system changes is not in use. However, FAA and Massport continue to work toward the current goals. Phase 3 of BLANS is currently underway and will be developing a new runway use plan.
	Runway Restrictions	Noise-based use restrictions 24 hours per day on departures from Runway 4L and arrivals on Runway 22R were continued.
	Reduced-Engine Taxiing	Voluntary use of reduced-engine taxiing is encouraged when appropriate and safe.
Improve Noise Monitoring System	Replace Existing Noise Monitors, Install Multilateration Antennas for Flight Track Monitoring, and Install New Robust Software	The Airscene noise monitoring system is completely installed and in use at Logan Airport. The noise monitors provide 1/3 octave band data at all sites to aide with aircraft identification. Noise events, flight events, and complaints are all linked. Multilateration provides improved radar coverage near the ground to help in identification of aircraft and runway assignment.
		In 2014, Massport received the latest version of the noise monitoring software and upgraded the community web portal for flight tracks.
Minimize nighttime noise	Nighttime Stage 2 Aircraft Prohibition	Prohibition on Stage 2 aircraft operations at Logan Airport between 11:00 PM and 7:00 AM was continued.
	Nighttime Runway Restrictions	Prohibitions on use of Runway 4L for departures and Runway 22R for arrivals between 11:00 PM and 6:00 AM were continued.
	Maximization of Late-Night Over-Water Operation	Efforts to maximize late-night over-water operations were continued. Use of Runway 15R for departures and Runway 33L for arrivals continued.
	Nighttime Engine Run-up and APU Restrictions	Restriction on nighttime engine run-ups and use of auxiliary power units (APUs) was continued.
Address/respond to noise issues and complaints	Noise Complaint Line	Massport continued operation of Noise Complaint Line, (617) 561-3333. In 2014, Massport's Noise Abatement Office responded to 12,855 calls from callers living in 82 communities. (See *Appendix H, Noise Abatement)*.
	Special Studies	Massport continued to provide technical assistance and analysis using noise monitoring system to support FAA and others in monitoring jet departure tracks from Runway 27 and Runway 33L. The BLANS Phase 3 is underway and will evaluate and establish a runway use program.

Source: Massport.

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7

Air Quality/ Emissions Reduction

Introduction

This chapter describes the air quality conditions at Logan Airport in 2014 and compares them to 2013 conditions. This information is based on an up-to-date emissions inventory of modeled Airport-related volatile organic compounds (VOCs), oxides of nitrogen (NO_x), carbon monoxide (CO), and particulate matter (PM).[1] An inventory of greenhouse gases (GHGs) is included. Status reports are also provided on Massport's Air Quality Initiative (AQI), the Massport Air Quality Monitoring Study, and other Massport air quality and emissions reduction initiatives.

2014 Air Quality Highlights and Key Findings

Total emissions from all sources associated with Logan Airport in 2014 are significantly less than they were a decade ago. This continuous downward trend is consistent with Massport's longstanding objective to accommodate the demands of increasing passenger and cargo activity levels with fewer aircraft operations and to reduce vehicle miles traveled (VMT) generated by Massport-controlled ground transport systems.

- Overall, modeled air quality emissions were similar in 2014 compared to 2013 and followed recent trends. The changes in 2014 modeled air quality emissions, as compared to 2013, are primarily due to technical changes in the model itself. Inputs to the model include aircraft operations, aircraft fleet mix characteristics, and airfield taxi times combined with ground service equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. A synopsis of these model input variables and model updates for 2014 at Logan Airport includes:
  - Aircraft operations went up by approximately 0.7 percent (i.e., 180,670 landing and take offs (LTOs) in 2013 versus 181,899 LTOs in 2014)[2] and aircraft taxi times went down by approximately 1 percent (i.e., 25.0 minutes in 2013 verses 24.9 minutes in 2014). For comparison to historical conditions, there were 243,998 LTOs in 2000 and the corresponding aircraft taxi times were about 27 minutes. On-Airport VMT went down by approximately 10.5 percent in 2014 compared to 2013. This change was largely due to the roadway and transportation improvements implemented by Massport associated with the Rental

1 PM less than or equal to 10 microns (PM_{10}) and PM less than or equal to 2.5 microns ($PM_{2.5}$) are subsets of PM.
2 Due to rounding of the operations (1 LTO = 2 Operations) there may be some very small differences (+/-) between the values reported here and those reported in *Chapter 2, Activity Levels.* In 2014 there were a total of 363,797 aircraft operations.

Car Center and its consolidated shuttle bus system. (See *Chapter 5, Ground Access to and from Logan Airport*, for additional information).

- Motor vehicle emission factors for the 2014 analysis were obtained from the newest version of the United States Environmental Protection Agency's (EPA's) Motor Vehicle Emission Simulator model (MOVES2014) combined with Massachusetts Department of Environmental Protection (MassDEP) - recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters. For comparative purposes, the previous version of MOVES (MOVES2010b) was also evaluated.

  In general, when compared to MOVES2010b, the MOVES2014 emission factors increased for VOC and $PM_{10}/PM_{2.5}$ and decreased for NO_x and CO. This resulted in a modeled increase in VOC and $PM_{10}/PM_{2.5}$ emissions despite the decrease in vehicle miles traveled. The GSE emission factors from the Emissions Dispersion Modeling System (EDMS) database decreased in 2014 when compared to 2013, as the model assumes fleet modernization from year to year. The lower emission factors resulted in a modeled decrease in GSE emissions despite the increase in aircraft operations.

- Natural gas usage by stationary sources (e.g., boilers, snow melters, and space heaters) increased by approximately 4 percent in 2014 when compared to 2013 (i.e., 402 million cubic feet and 419 million cubic feet, respectively). Diesel fuel usage by the snow melters decreased in 2014 when compared to 2013 (231,130 gallons in 2013 and 124,480 gallons in 2014).

The modeled air quality conditions in 2014 for Logan Airport were as follows:

- Total VOC emissions went up by 3 percent (1,177 kilograms per day [kg/day]) in 2014 compared to 2013. The small increase is primarily due to the corresponding increase in aircraft LTOs and an increase in jet fuel and gasoline usage when compared to 2013. For comparison, total VOC emissions were 1,777 kg/day in 2000.
- Total NO_x emissions went up by less than 1 percent in 2014 (4,040 kg/day) compared to 2013. This slight increase in 2014 is mostly attributable to the larger number of air carrier operations during this time period. In 2000, total NO_x emissions were 5,707 kg/day.
- Total CO emissions went down by 5 percent in 2014 (6,987 kg/day) compared to 2013. This decrease is mostly attributable to the decrease in GSE emission factors and motor vehicle emission factors in accordance with MOVES2014. For comparison, total CO emissions were 13,111 kg/day in 2000.
- Total $PM_{10}/PM_{2.5}$ emissions went up by approximately 3 percent in 2014 (95 kg/day) compared to 2013. This small increase is primarily attributable to the higher emission factors of MOVES2014.
- Total GHG emissions went down by approximately 1 percent (0.60 Million Metric Tons [MMT]) in 2014 compared to 2013. The year 2014 marks the eighth consecutive year in which Massport has voluntarily prepared a GHG emissions inventory for the EDR/ESPR. This decrease was primarily due to a decrease in on-Airport VMT. In 2014, Logan Airport's GHG emissions made up less than 1 percent of state totals.
- Massport's AQI[3] has tracked NO_x emissions since the benchmark year of 1999. Total NO_x emissions in 2014 were 722 tons per year (tpy) lower than the 1999 benchmark - which represents an overall decrease of 31 percent in NO_x emissions since 1999 when the program was initiated. For comparison, NO_x emissions in 2013 were 730 tpy lower than the benchmark.

3 Massport developed the AQI as a 15-year voluntary program with the overall goal to maintain NO_X emissions associated with Logan Airport at, or below, 1999 levels.

Regulatory Framework

The federal Clean Air Act (CAA), the National Ambient Air Quality Standards (NAAQS), and similar state laws govern air quality issues in Massachusetts. The NAAQS and the Massachusetts State Implementation Plan (SIP), which describes measures that the state will take to attain NAAQS compliance, regulate air quality issues in the Boston metropolitan area and the state, and are discussed in the next section.

National Ambient Air Quality Standards

EPA established NAAQS for a group of criteria air pollutants to protect public health, the environment, and the quality of life from the detrimental effects of air pollution. These NAAQS are set for the following seven pollutants: CO, lead (Pb), NO_2, ozone (O_3), PM_{10}, $PM_{2.5}$, and sulfur dioxide (SO_2). The NAAQS primary standards (designed to protect human health) and secondary standards (designed to protect human welfare) are summarized on Table 7-1.

Based on air monitoring data and in accordance with the CAA, all areas within Massachusetts are designated as either *attainment*, *nonattainment*, *maintenance*, or *unclassifiable* with respect to the NAAQS.[4] An area with air quality better than the NAAQS is designated as attainment; an area with air quality worse than the NAAQS is designated as nonattainment; and an area that is in transition from nonattainment to attainment is designated as attainment/maintenance. An area may also be designated as unclassifiable when there is a temporary lack of data to form a basis for determining attainment status. Nonattainment areas can be further classified as extreme, severe, serious, moderate, and marginal by the degree of non-compliance with the NAAQS. The current attainment/nonattainment designations for the Boston metropolitan area are summarized in Table 7-2.

The Boston area is currently designated as attainment/maintenance for CO, indicating that it is in transition back to attainment for this pollutant. Historically, the entire Boston metropolitan area has been designated as attainment for all other criteria pollutants except O_3, for which it was designated as "moderate" nonattainment based on the former 1997 eight-hour ozone standard (see Table 7-2). This O_3 nonattainment area consisted of 10 counties in Massachusetts (Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester). Logan Airport is located in Suffolk County. In May 2012, EPA issued a Clean Data Finding for the Boston area ruling that the area has attained the 1997 NAAQS for O_3, designating the area as attainment/maintenance so long as the area continues to demonstrate attainment based on monitoring data. Even despite the clean data finding, the anti-backsliding requirements of the federal CAA (i.e., a rule established to ensure that air quality is not deteriorated due to EPA relaxing or revoking NAAQS) still obligates the MassDEP to enforce select elements of any federally enforceable SIP prepared to attain the 1997 NAAQS. In April 2012, EPA began implementing the 2008 eight-hour O_3 standard of 0.075 parts per million (ppm).

With respect to the 2008 O_3 NAAQS, in 2014 Massachusetts experienced its first ozone season without an exceedance of the 75 parts per billion (ppb) standard. This was due in part to weather patterns that resulted in fewer days above 90 degrees F. Attainment of the standard is based on the most recent three-year period. Preliminary O_3 values for 2012 - 2014 show Massachusetts attains the 0.075 ppm standard statewide. MassDEP submitted the state's State Implementation Plan (SIP) for Ozone to EPA in 2014 for adequacy review and the outcome is still pending; thus the area remains attainment/unclassifiable.

4 Environmental Protection Agency, The Green Book Nonattainment Areas for Criteria Pollutants (www.epa.gov/air/oaqps/greenbk/).

Table 7-1 National Ambient Air Quality Standards

Pollutant	Averaging Time	Standard ppm	Standard µg/m³	Notes:
Carbon Monoxide (CO)	1 hour	35	40,000	Not to be exceeded more than once a year.
	8 hour	9	10,000	Not to be exceeded more than once a year.
Lead (Pb)	Rolling 3-Month Average	—	0.15	Not to exceed this level. Final rule October 2008.
	Quarterly	—	1.5	The 1978 standard (1.5 µg/m³ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
Nitrogen Dioxide (NO_2)	1 hour	0.100	188	The three-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm.
	Annual	0.053	100	Not to exceed this level.
Ozone (O_3)	8 hour[1]	0.08	—	The average of the annual 4th highest daily 8-hour maximum over a three-year period is not to exceed this level.
	8 hour[2]	0.075	—	The average of the annual 4th highest daily 8-hour maximum over a three-year period is not to exceed this level.
Particulate Matter with a diameter ≤ 10µm (PM_{10})	24 hour	—	150	Not to be exceeded more than once a year on average over three years.
Particulate Matter with a diameter ≤ 2.5µm ($PM_{2.5}$)	24 hour	—	35	The three-year average of the 98th percentile for each population-oriented monitor within an area is not to exceed this level.
	Annual (Primary)	—	12	The three-year average of the weighted annual mean from single or multiple monitors within an area is not to exceed this level.
	Annual (Secondary)	—	15	The three-year average of the weighted annual mean from single or multiple monitors within an area is not to exceed this level.
Sulfur Dioxide (SO_2)	1 hour	0.075	196	Final rule signed June 2, 2010. The three-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed this level.
	3 hour	0.5	1,300	Not to be exceeded more than once a year.

Source: EPA, 2015 (www.epa.gov/air/criteria.html).
1 The 1997 NAAQS for ozone.
2 The 2008 NAAQS for ozone.
ppm Parts per million
µg/m³ Micrograms per cubic meter

Table 7-2 Attainment/Nonattainment Designations for the Boston Metropolitan Area

Pollutant	Designation
Carbon monoxide (CO)	Attainment/Maintenance[1]
Nitrogen Dioxides (NO_2)	Attainment
Ozone (Eight-hour, 1997 Standard)	Attainment/Maintenance[1]
Ozone (Eight-hour, 2008 Standard)	Attainment/Unclassifiable[2]
Particulate matter (PM_{10})	Attainment
Particulate matter ($PM_{2.5}$)	Attainment
Sulfur Dioxide (SO_2)	Attainment
Lead (Pb)	Attainment

Source: EPA, 2015 (www.epa.gov/air/oaqps/greenbk/).
1 The Boston area was previously designated nonattainment for this pollutant but has since attained compliance with the NAAQS.
2 Attainment/Unclassifiable means that the initial data shows attainment but additional data is needed to verify longer term conditions.

State Implementation Plan (SIP)

A SIP is a state's regulatory plan for bringing nonattainment areas within that state into compliance with the NAAQS. As indicated previously, the entire Boston metropolitan area was formerly designated as "moderate" nonattainment for the 1997 eight-hour O_3 standard, but has since received a Clean Air Determination from the EPA classifying the area as "attainment/maintenance." Additionally, as stated above, the area has been designated attainment/unclassifiable for the 2008 eight-hour O_3 standard, and accordingly SIP preparation relative to this standard are pending for the Boston area.

For the former CO attainment/maintenance designation, MassDEP has also developed another 10-year Maintenance Plan which is currently under review by EPA. The most current SIP submittals for the Boston area are summarized in Table 7-3.

Table 7-3 State Implementation Plan (SIP) for Boston Area

Standard	Title	Status	Comments
Carbon Monoxide	Maintenance Plan	Published in 2014, under review by EPA	This Maintenance Plan is required for any area that was formerly designated as non-attainment to show that it will not digress. It is expected that this plan will be approved by EPA.
Ozone	2008 SIP	Submitted to EPA in 2014 for review	As of April 2014, MassDEP has determined that the Boston area is still compliant with the 2008 standard, thus the SIP status is currently pending. [1]

Source: MassDEP (http://www.mass.gov/eea/agencies/massdep/air/reports/state-implementation-plans.html).
Notes: The number of commercial and employee parking spaces allowed at Logan Airport is regulated by the Logan Airport Parking Freeze (310 Code of Massachusetts Regulations 7.30 and 40 CFR 52.1120), which is an element of the Massachusetts State Implementation Plan (SIP) under the Federal Clean Air Act.
1 In 2007, the EPA promulgated a new eight-hour NAAQS for ozone. Informally called the "2008 standard" to differentiate it from the former "1997 standard", this new standard is more strict (i.e., lower) than the former standard.

Logan Airport Air Quality Permits for Stationary Sources of Emissions

Massport was granted a Title V Air Quality Operating Permit for Logan Airport in September 2004; a renewal permit was granted in January 2013. This permit covers all of the Massport-operated stationary sources including the Central Heating and Cooling Plant, snow melters, fuel dispensers, boilers, emergency electrical generators, and fuel storage tanks.

Methodology

For the purposes of the EDR, the analysis of air emissions associated with Logan Airport operations includes the following source categories, each of which has its own assessment methodology, database, and assumptions as described below.

- **Aircraft Emissions** — The Federal Aviation Administration's (FAA) EDMS was used for this analysis. However, EDMS was replaced with FAA's Aviation Environmental Design Tool (AEDT) on May 29, 2015. Since, the air quality modeling was begun before this date, EDMS was used to complete the analysis. The next EDR and subsequent EDRs and ESPRs will deploy the AEDT model with a comparison to the EDMS model in the 2014 EDR. The last, most recent, version of EDMS was used (EDMS v5.1.4.1).

  As with recent ESPRs and EDRs, the actual aircraft fleet mix at Logan Airport in 2014 was used as a model input to analyze annual conditions. In a few instances where the aircraft/engine type or combinations operating at Logan Airport were not available in the EDMS database, consistent with FAA guidance, substitutions were made based on the closest match of aircraft type and engine performance characteristic. Tables I-4 and I-5 in *Appendix I, Air Quality/Emissions Reduction* contains the data that were used, including aircraft types, engine, LTOs, and aircraft taxi/delay times for 2014. For the analysis, the aircraft are grouped into four categories: commercial air carriers, commuter aircraft, general aviation (GA), and cargo aircraft.

  From 2013 to 2014, total LTOs increased by less than 1 percent overall with air carrier LTOs increasing by 2 percent, commuter LTOs decreasing by three percent, air cargo LTOs increasing by about 6 percent, and GA decreasing by less than 1 percent.

  Updated aircraft taxi/delay times are based on data obtained from the FAA Aviation System Performance Metrics (ASPM) database for 2014.[5] According to this database, the average aircraft taxi/delay times at Logan Airport decreased from 25.0 minutes to 24.9 minutes from 2013 to 2014, or about one percent. These parameters also served as inputs into the air quality modeling.

- **Ground Service Equipment/Auxiliary Power Units** — Estimates of GSE emissions were based on EDMS emission factors and continue to reflect emission reductions attributable to Massport's Alternative Fuel Vehicle (AFV) Program and the conversion of Massport and/or tenant GSE and fleet vehicles to compressed natural gas (CNG) or electricity. The GSE emission factors from the EDMS database decreased measurably for most equipment in 2014 when compared to 2013. Model input data are based on an on-site GSE time-in-mode survey conducted in May 2012 at the Airport as part of the *2011 ESPR*, combined with

5 FAA Aviation System Performance Metrics (ASPM) database for 2014 (aspm.faa.gov/).

the most recent information regarding GSE fuel use (e.g., gasoline, diesel, CNG, liquid petroleum gas (LPG), and electric) from the Logan Airport Vehicle Aerodrome Permit Application documentation.[6]

- **Motor Vehicles** — Motor vehicle emission factors were obtained from the new, and most recent, version of EPA's MOVES model (MOVES2014) combined with MassDEP-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters.[7] For comparative purposes, both MOVES2010b and MOVES2014 were evaluated. The emission factors obtained from MOVES2014 were measurably higher for VOC and PM and comparably lower for CO and NO_X. The MOVES input/output files are included in *Appendix I, Air Quality/Emissions Reduction*. In addition, *Chapter 5, Ground Access to and from Logan Airport* of this *2014 EDR* provides a discussion of the on-Airport VMT data used for this analysis. Starting with the *2011 ESPR*, on-Airport VMT and vehicle speed data were predicted by the traffic simulation model, VISSIM.[8] (Refer to *Chapter 5, Ground Access to and from Logan Airport* for more information on ground transportation to and from Logan Airport, as well traffic conditions at the Airport).
- **Other Sources** — Emissions associated with fuel storage and handling, the Central Heating and Cooling Plant, snow melters, generators, space heaters, and fire training at Logan Airport were based on annual fuel throughput records for 2014, combined with appropriate EPA emission factors (e.g., compilation of *Air Pollution Emission Factors* (*AP-42*) or emission factors obtained from NO_x Reasonably Available Control Technology (RACT) compliance testing). When 2014 is compared to 2013, No. 2 fuel oil, No. 6 fuel oil, and natural gas usage from boilers usage increased approximately 1 percent, 335 percent, and 4 percent, respectively, while diesel fuel from snow melters decreased by approximately 46 percent.
    - In November 2014, Massport converted the Central Heating Plant (CHP) fuel oil system from No. 6 to No. 2 fuel oil. During the conversion, the CHP retained the ability to burn natural gas, which it burns approximately 97 percent of the time. Converting the CHP fuel oil system allows Massport to reduce energy use and air emissions while maintaining the ability to use backup fuel oil in the event of a disruption of natural gas service. Before switching to No. 2 fuel oil, Massport used all the remaining No. 6 fuel oil. Therefore, the increased use of No. 6 fuel oil in 2014 is attributable to this conversion combined with an unusually cold winter in early 2014; the 53rd coldest winter on record in the Boston area.
- **Particulate Matter** — Estimates of PM emissions associated with Logan Airport were first reported in the *2005 EDR* in response to the then recent availability of an FAA-updated method (i.e., *First Order Approximation*) for computing aircraft $PM_{10}/PM_{2.5}$ emission factors. $PM_{10}/PM_{2.5}$ emissions are now routinely reported in the EDRs/ESPRs - including this *2014 EDR*.
- **Greenhouse Gases** — GHG emissions were calculated in much the same way the criteria pollutants (and their precursors) were calculated - through the use of input data such as activity levels or material throughput rates (i.e., fuel usage, VMT, electrical consumption) that are applied to appropriate emission factors (i.e., in units of GHG emissions per gallon of fuel). Input data were either based on Massport records, or data and information derived from the EDMS v5.1.4.1. Emission factors were obtained from the U.S. Energy Information Administration (EIA), the International Panel on Climate Change (IPCC), and the EPA.

6 All vehicles and equipment (including GSE) that operate on the airfield must obtain a Logan Airport Vehicle Aerodrome Permit. The application form for this permit was modified in 2007 to request the fuel-type information (e.g., gasoline, diesel, etc.).

7 The U.S. EPA MOVES model is an advancement to the former MOBILE6 model as it contains the most up-to-date emission factors, emission control measures, and other area-specific parameters for motor vehicle fleets nationwide (including the Boston area). For consistency with the Massachusetts State Implementation Plan (SIP), MOVES is also recommended for use by the MassDEP.

8 PTV America. (2011). Verkehr In Städen Simulationsmodell- VISSIM version 5.40 [computer software]. Portland, OR.

Consistent with prior EDR years, the 2014 GHG emissions inventory includes aircraft operations within the ground-based taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle.[9] Again, GHG emissions associated with GSE/auxiliary power unit (APU), motor vehicles, a variety of stationary sources, and electricity usage were also included. Of note, Massport has direct ownership or control over a very small percentage (approximately 13 percent in 2014) of these GHG emissions and their sources (i.e., limited to Massport fleet vehicles, stationary sources, and electrical consumption within Massport buildings). As with most commercial service airports, the vast majority of the emission sources at Logan Airport are owned or controlled by the airlines, other airport tenants, and the general public (motor vehicles). Massport undertakes a variety of programs to reduce non-Massport emissions through its support of high-occupancy-vehicle (HOV) initiatives, including subsidizing free Silver Line Service, and supporting use of alternative fuels by airport taxis, the CNG station, and providing electric plug-ins for GSE, 400 Hz Power, and pre-conditioned air (PCA) at airplane gates.

Emissions Inventory in 2014

This section provides a summary of the 2014 Logan Airport emissions inventory for the pollutants VOC, CO, NO_x, and PM_{10}/$PM_{2.5}$. Emissions of O_3 are not directly computed as it is a secondary pollutant formed by the interactions of NO_x and VOCs throughout the region. Emissions of SO_2 and Pb are also not computed, as Logan Airport emission sources are very small generators of these two compounds.

As stated above, the aircraft emissions inventory was computed based on the actual number of aircraft operations (i.e., LTOs), fleet mix, and operational times-in-mode (TIM) at the Airport in 2014. Similarly, emissions associated with GSE, motor vehicles, fuel storage and transfer facilities, and a variety of stationary sources (e.g., steam boilers, snow melters, live-fire training, emergency generators, etc.) associated with Logan Airport were also computed based on actual conditions.

As in preceding EDRs, the results of the 2014 emissions inventory are primarily used for comparison to the results for the prior year (i.e., 2013). Additionally, the 2014 results are compared with previous years extending back to 1990. For ease of review, the data summary figures contain the previous results for 1990 and 2000 and then annually for 2010 to 2014. In this way, the changes in Logan Airport air quality conditions can be evaluated in both the short- and long-term time frame and on a common basis. For the AQI, estimates of NO_x emissions are also provided as a way of tracking the progress of this voluntary emission management program. Finally, the results for the intervening years (e.g., 1995, 1996, 1997, etc.) are shown in previous EDRs and contained in *Appendix I, Air Quality/Emissions Reduction.*

9 Following the guidance issued by the Airport Cooperative Research Program, ACRP Report 11, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*.

Volatile Organic Compounds

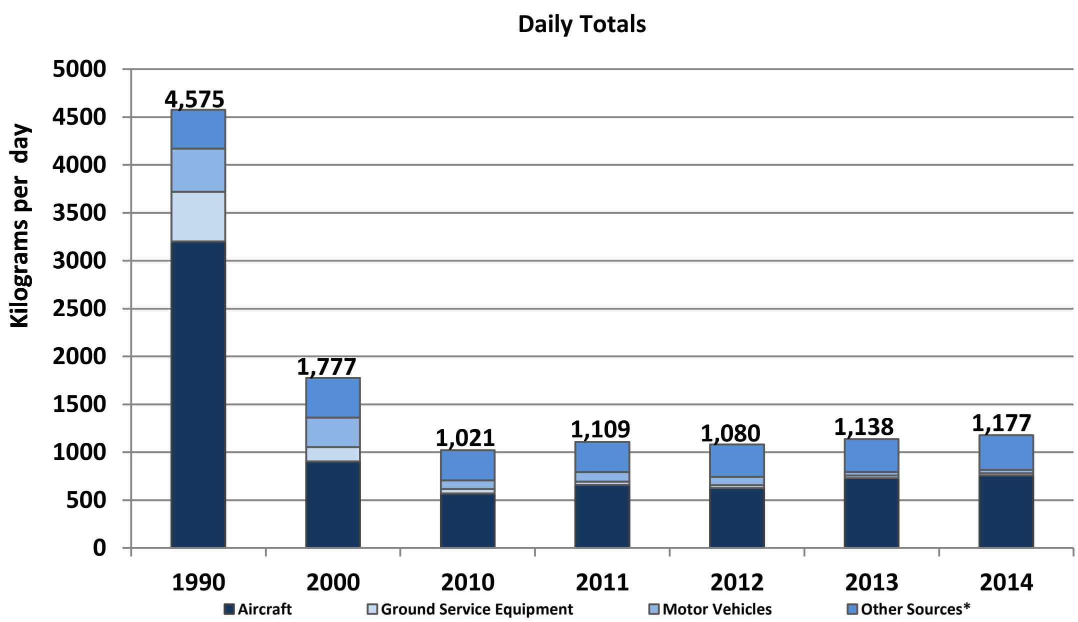
In 2014, total modeled VOC emissions at Logan Airport were 474 tpy (1,177 kg/day) – a computed increase of approximately 3 percent from 2013 levels. This increase is due mostly to the increase in VOC emissions associated with slightly higher aircraft operations at the Airport during this time period. Importantly, Figure 7- 1 depicts an overall, long-term downward trend in modeled VOC emissions at Logan Airport and Figure 7-2 shows the 2014 percent breakdown of these emissions by source category. Similarly, Table 7-4 shows the computed VOC emissions in kg/day for each emission source from 1990, 2000, and 2010 to 2014. Other key findings from this analysis include the following:

- Total aircraft-related VOC emissions were approximately 4 percent higher in 2014, when compared to 2013. This increase was mostly due to the increase in aircraft LTOs.
- GSE-related VOC emissions were approximately 12 percent lower in 2014 than in 2013. This decrease was largely due to the decrease in GSE emission factors.
- VOC emissions from motor vehicles in 2014 increased by about 6 percent from 2013 levels, despite reduced on-Airport VMT. This increase in motor vehicle emissions is attributable to higher emission factors for VOC computed by MOVES2014.
- The effect on 2014 VOC emissions using the new MOVES2014 motor vehicle emissions model was a model-related apparent increase of 100 percent in total motor vehicle emissions when compared to using MOVES2010b. If MOVES2010b was used for the 2014 analysis, motor vehicle VOC emissions would have decreased from 2013 values by about 47 percent.[10]
- VOC emissions from stationary and other non-mobile sources (e.g., fuel storage/handling, Central Heating and Cooling Plant, snow melter usage, and firefighter training) increased by approximately 4 percent from 2013 to 2014 - mostly due to the higher fuel storage/handling of jet fuel and gasoline.

As shown in Figure 7-2, in 2014 aircraft continued to represent the largest source (64 percent) of VOC emissions associated with Logan Airport, followed by stationary sources (31 percent), motor vehicles (3 percent), and GSE (2 percent). The 2014 results shown in Table 7-4 show a 3-percent increase of total modeled emissions of VOCs when compared to 2013. However, the overall, long-term trend over the past two decades reveals a substantial overall decrease in these emissions associated with the Airport.

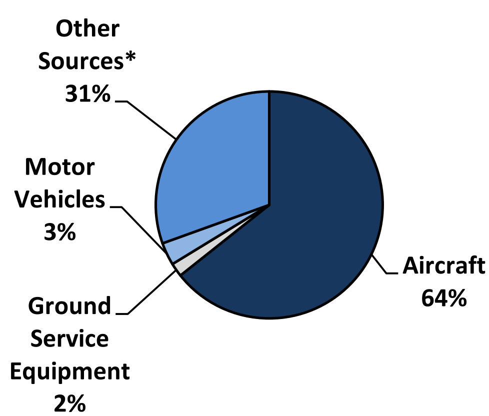
10 Further details can be found in EPA MOVES2014 Questions and Answers, www.epa.gov/otaq/models/moves.

Figure 7-1 Modeled Emissions of VOCs at Logan Airport, 1990, 2000, and 2010-2014



* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources.

Figure 7-2 Sources of VOC Emissions, 2014



* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.) and fueling sources.

Table 7-4	Estimated VOC Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2014[1]									
Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**	**EDMS v5.1.3**		**EDMS v5.1.3**	**EDMS v5.1.4.1**		
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**		**MOBILE 6.2.03**		**MOBILE 6.2.03**	**MOVES 2010b**		**MOVES 2014**
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**	
Aircraft Sources										
Air carriers	2,175	514	292	292	305	378	448	447	480	480
Commuter aircraft	681	140	129	125	110	91	91	91	85	85
Cargo aircraft	303	207	70	70	69	63	44	44	48	48
General aviation	44	42	81	81	176	93	149	149	144	144
Total aircraft sources	3,203	903	572	568	660	626	732	731	757	757
Ground Service Equipment[2]	518	153	49	49	33	30	26	26	23	23
Motor Vehicles										
Ted Williams Tunnel through-traffic	N/A	12	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]
Parking/curbside[4]	192	89	20	20	20	18	17	5	3	4
On-airport vehicles	258	206	68	68	81	70	67	31	16	34
Total motor vehicle sources	450	307	88	88	101	88	84	36	19	38
Other Sources										
Fuel storage/handling[5]	400	412	311	311	311	332	340	340	354	354
Miscellaneous sources[5]	4	2	5	5	4	4	5	5	5	5
Total other sources	404	414	316	316	315	336	345	345	359	359
Total Airport Sources	4,575	1,777	1,025	1,021	1,109	1,080	1,187	1,138	1,158	1,177

Source: Massport

Notes: Years 2010 and 2013 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day = kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).

N/A Not Available.

1 See *Appendix I, Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic (which is defined as traffic passing through but not destined for the Airport) at Logan Airport beginning in 2003.

4 Parking/curbside is based on VMT analysis.

5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Oxides of Nitrogen

In 2014, total NO_x emissions from all Airport-related sources were estimated to be 1,625 tpy (4,040 kg/day), which is an increase of less than 1 percent from 2013 levels. However, this occurrence should also be taken within the context of an overall decrease of 30 percent from 1999 levels. As discussed later in this chapter, the year 1999 is the benchmark of the AQI for NO_x emissions associated with the Airport. Figure 7-3 depicts these short- and long-term trends in NO_x emissions and Table 7-5 shows the NO_x contribution for each emission source in 1990, 2000, and 2010 through 2014.

Other findings related to the NO_x emissions inventory results include the following:

- When compared to 2013 values, total aircraft-related NO_x emissions were 3 percent higher in 2014. This increase is largely due to the increase in air carrier and cargo operations compared to other aircraft in the fleet.[11]
- GSE emissions of NO_x decreased by 8 percent in 2014 compared to 2013, due mostly to the decrease in GSE emission factors.
- NO_x emissions from motor vehicles in 2014 decreased by approximately 54 percent from 2013 levels. This reduction is attributable mostly to lower NO_x emission factors computed by MOVES2014 and 10.5 percent lower on-Airport VMT.
- Stationary sources show an increase of approximately 3 percent in NO_x emissions in 2014 compared to 2013, mostly due to the higher usage of the boilers that year (due to the cold, snowy winter).
- The effect on 2014 emissions calculations on NO_x by the MOVES2014 model was a decrease of about 33 percent in total modeled motor vehicle emissions when compared to MOVES2010b.[12] If MOVES2010b was used for the 2014 analysis, total motor vehicle NO_x emissions would have decreased about 31 percent from 2013 levels.

Again, the overall, long-term trend over the past two decades reveals a substantial decrease in total NO_x emissions associated with the Airport.

11 Larger aircraft are generally higher NOx emitters than commuter or general aviation aircraft.
12 Further details can be found in EPA MOVES2014 Questions and Answers, www.epa.gov/otaq/models/moves.

Table 7-5	Estimated NO_X Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2014[1]									
Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**	**EDMS v5.1.3**		**EDMS v5.1.3**	**EDMS v5.1.4.1**		
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**		**MOBILE 6.2.03**		**MOBILE 6.2.03**	**MOVES 2010b**		**MOVES 2014**
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**	
Aircraft Sources										
Air carriers	4,554	4,202	3,031	3,037	3,128	3,154	3,090	3,158	3,245	3,245
Commuter aircraft	133	125	203	204	199	182	168	152	155	155
Cargo aircraft	237	284	197	197	196	192	188	188	203	203
General aviation	13	49	29	26	43	115	46	48	48	48
Total aircraft sources	4,937	4,660	3,460	3,464	3,566	3,644	3,492	3,546	3,651	3,651
Ground Service Equipment[2]	603	333	198	198	173	164	145	145	134	134
Motor Vehicles										
Ted Williams Tunnel through-traffic	N/A	26	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]
Parking/curbside[4]	25	52	12	12	11	10	9	16	11	6
On-airport vehicles	232	425	144	144	148	128	117	131	90	62
Total motor vehicle sources	257	503	156	156	159	137	126	147	101	68
Other Sources										
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	344	211	166	166	179	154	182	182	187	187
Total other sources	344	211	166	166	179	154	182	182	187	187
Total Airport Sources	6,141	5,707	3,980	3,984	4,077	4,099	3,945	4,020	4,073	4,040

Source: Massport

Notes: Years 2010 and 2013 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.
kg/day - kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).

N/A Not Available

1 See *Appendix I, Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

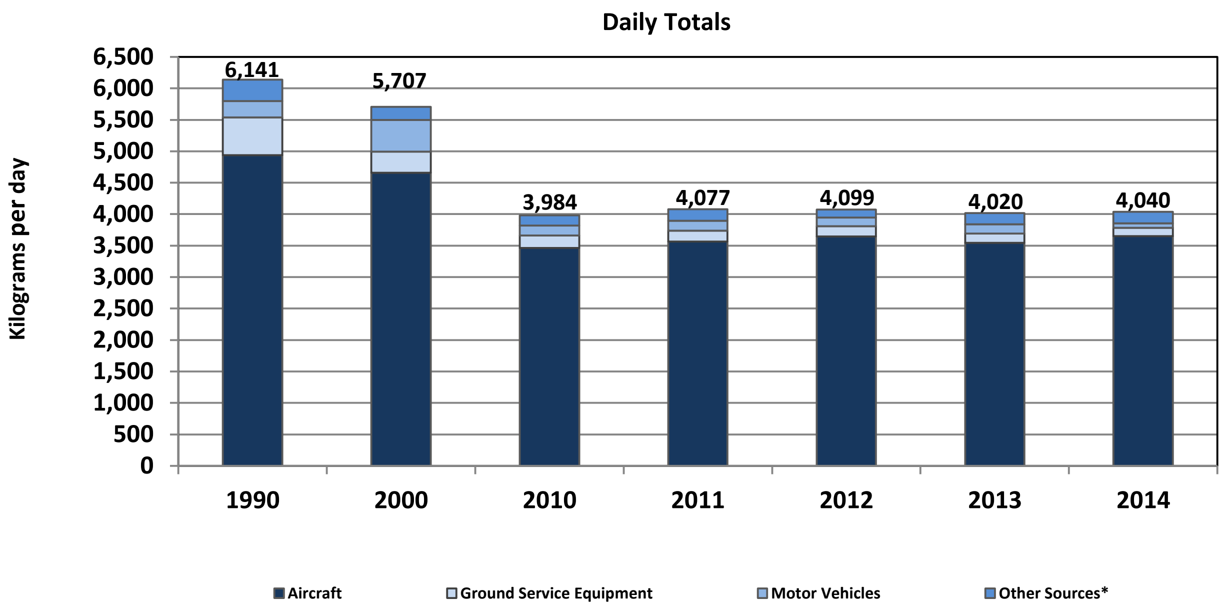
3 Due to the new roadway configuration and opening of the Ted Williams Tunnel (TWT) there was no TWT through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside data is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of NO_x emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

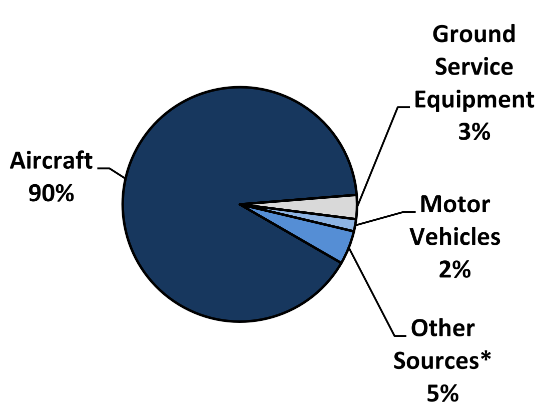
Figure 7-3 Modeled Emissions of NO_X at Logan Airport, 1990, 2000, and 2010 to 2014



* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, firefighter training, etc.).

As shown in Figure 7-4, aircraft continued to represent the largest source (90 percent) of NO_x at Logan Airport, followed by stationary sources (5 percent), GSE (3 percent), and motor vehicles (2 percent).

Figure 7-4 Sources of NO_X Emissions, 2014



* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).

Carbon Monoxide

Total modeled CO emissions at Logan Airport in 2014 were 2,811 tpy (6,987 kg/day), approximately 5 percent lower than 2013 levels. Figure 7-5 depicts a continued long-term downward trend (60 percent overall reduction from 1990 to 2014) in CO emissions associated with Airport activities. Table 7-6 also shows the breakdown of these emissions, by source category, for the years 1990, 2000, and 2010 to 2013. Other notable findings of the analysis include:

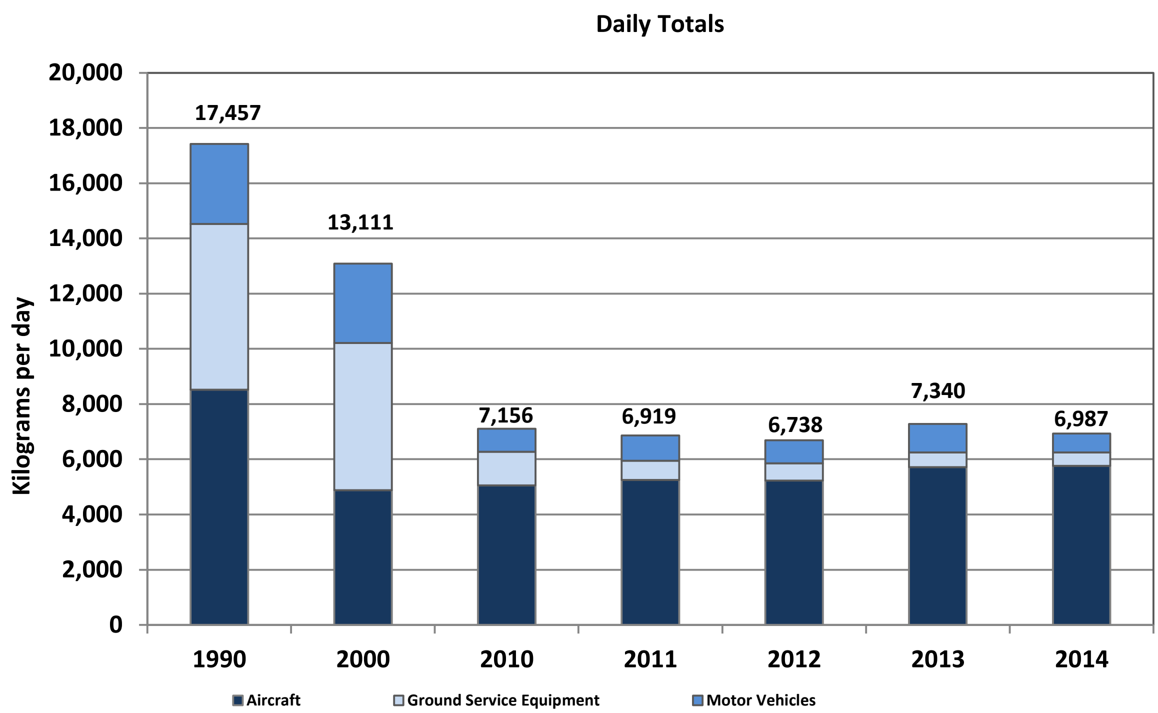
- Aircraft-related CO emissions increased in 2014 by less than 1 percent compared to 2013 levels, due mostly to the increase in aircraft LTOs.
- GSE CO emissions decreased by approximately 9 percent in 2014 compared to 2013, due mostly to the decrease in GSE emission factors.
- CO emissions from motor vehicles declined in 2014 by approximately 34 percent from 2013 levels. This reduction is attributable mostly to the lower emission factors of the motor vehicle fleet, which are reflected in the MOVES2014 database, and a decrease in on-Airport VMT.[13]
- Stationary sources show a decrease of approximately 2 percent in CO emissions in 2014 compared to 2013, largely due to the lower usage of the snow melters. Reduction in snow melter use for the year 2014 is a result of the unusually delayed snow fall during the 2014/2015 winter. The majority of snowfall occurred in 2015.
- The effect on 2014 modeled motor vehicle emissions of CO by the MOVES2014 model was an increase of 5 percent in total motor vehicle emissions when compared to MOVES2010b.[14] If MOVES2010b was used for the 2014 analysis, the decrease in motor vehicle CO emissions from 2013 would have been 37 percent.

Again, as with total emissions of VOCs and NO_x, the overall, long-term trend over the past two decades reveals a substantial decrease in total CO emissions (60 percent since 1990) associated with the Airport.

As shown in Figure 7-6, for 2014, aircraft emissions continued to represent the largest source (82 percent) of CO at Logan Airport, followed by motor vehicles (10 percent), GSE (7 percent), and stationary sources (less than 1 percent).

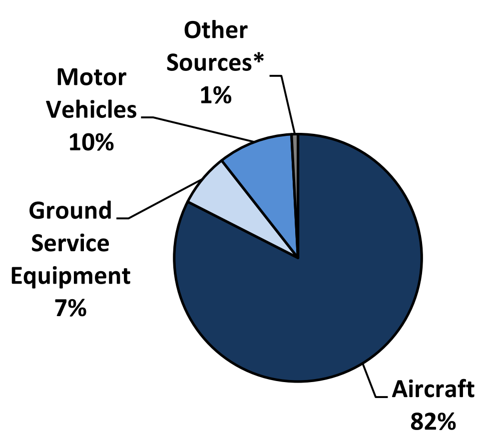
13 Further details can be found in EPA MOVES2014 Questions and Answers, www.epa.gov/otaq/models/moves.
14 Ibid.

Figure 7-5 Modeled Emissions of CO at Logan Airport, 1990, 2000, and 2010 to 2014



Note: Other stationary sources not shown (this source made up less than 1 percent of the total).

Figure 7-6 Sources of CO Emissions, 2014



* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).

Table 7-6	**Estimated CO Emissions (in kg/day) at Logan Airport, 1990, 2000, and 2010-2014[1]**									
Aircraft/GSE Model:	**Logan Dispersion Modeling System (LDMS)**	**EDMS v4.03**	**EDMS v5.1.2**	**EDMS v5.1.3**	**EDMS v5.1.3**		**EDMS v5.1.3**	**EDMS v5.1.4.1**		
Motor Vehicle Model:	**MOBILE 5a**	**MOBILE 6.0**	**MOBILE 6.2.03**		**MOBILE 6.2.03**		**MOBILE 6.2.03**	**MOVES 2010b**		**MOVES 2014**
Year:	**1990**	**2000**	**2010**		**2011**	**2012**	**2013**		**2014**	
Aircraft Sources										
Air carriers	6,613	2,994	2,531	2,531	2,592	2,816	3,320	3,323	3,486	3,486
Commuter aircraft	977	1,188	2,629	2,086	2,042	1,928	1,978	1,907	1,795	1,795
Cargo aircraft	576	400	248	259	246	183	155	155	164	164
General aviation	352	295	177	173	370	304	345	334	319	319
Total aircraft sources	8,518	4,876	5,585	5,049	5,250	5,232	5,798	5,719	5,764	5,764
Ground Service Equipment[2]	6,001	5,335	1,222	1,222	694	618	533	533	484	484
Motor Vehicles										
Ted Williams Tunnel through-traffic	N/A	133	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]	—[3]
Parking/curbside[4]	1,218	495	106	106	110	104	104	94	57	51
On-airport vehicles	1,689	2,245	726	726	806	737	742	935	591	630
Total motor vehicle sources	2,907	2,873	832	832	916	840	846	1,029	648	681
Other Sources										
Fuel storage/handling[5]	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	31	27	53	53	59	48	59	59	58	58
Total other sources	31	27	53	53	59	48	59	59	58	58
Total Airport Sources	17,457	13,111	7,692	7,156	6,919	6,738	7,236	7,340	6,954	6,987

Source: Massport

Notes: Years 2010 and 2013 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

N/A Not Available

1 See *Appendix I, Air Quality/Emissions Reduction* for 1993 to 2009 emission inventory results.

2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.

3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.

4 Parking/curbside is based on VMT analysis.

5 Fuel storage/handling facilities are not a source of NO_x emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Particulate Matter

Table 7-7 shows that total estimated $PM_{10}/PM_{2.5}$ emissions at Logan Airport in 2014 were 38 tpy (95 kg/day), or approximately 3 percent higher than 2013 levels. Explanations of these results and other key findings include:

- Estimated aircraft-related $PM_{10}/PM_{2.5}$ emissions remained approximately the same in 2014 compared to 2013 levels.
- Modeled $PM_{10}/PM_{2.5}$ associated with GSE/APU emissions also remained approximately the same in 2014 when compared to 2013.
- $PM_{10}/PM_{2.5}$ emissions from motor vehicles increased approximately 20 percent in 2014 when compared to 2013 levels, primarily attributable to the higher emission factors computed by MOVES2014.
- Stationary source emissions of $PM_{10}/PM_{2.5}$ remained approximately the same in 2014 compared with 2013.
- The effect on calculated 2014 emissions of $PM_{10}/PM_{2.5}$ by the MOVES2014 motor vehicle emissions model was an increase of 29 percent in total motor vehicle emissions when compared to MOVES2010b. If MOVES2010b was used for the 2014 analysis, motor vehicle $PM_{10}/PM_{2.5}$ emissions would be approximately 7 percent less than in 2013.

As shown in Figures 7-7 and 7-8, aircraft represent the largest (65 percent) source of $PM_{10}/PM_{2.5}$ followed by motor vehicles (19 percent), GSE (13 percent), and stationary sources, such as the Central Heating and Cooling Plant, snow melter usage, and fire training (3 percent).

Table 7-7 Estimated $PM_{10}/PM_{2.5}$ Emissions (in kg/day) at Logan Airport, 2010-2014[1]

Aircraft/GSE Model:	EDMS v5.1.2	EDMS v5.1.3	EDMS v5.1.3		EDMS v5.1.3	EDMS v5.1.4.1		
Motor Vehicle Model:	MOBILE 6.2.03		MOBILE 6.2.03		MOBILE 6.2.03	MOVES 2010b		MOVES 2014
Year:	2010		2011	2012	2013		2014	
Aircraft Sources								
Air carriers	34	34	35	43	41	48	48	48
Commuter aircraft	4	4	3	2	2	7	7	7
Cargo aircraft	3	3	3	3	2	3	3	3
General aviation	2	2	4	3	3	4	4	4
Total aircraft sources	43	43	45	51	48	62	62	62
Ground Service Equipment[2]	13	13	13	13	12	12	12	12
Motor Vehicles								
Parking/curbside[4]	<1	<1	<1	<1	<1	<1	<1	<1
On-airport vehicles	6	6	6	6	6	14	14	18
Total motor vehicle sources	6	6	6	6	6	15	14	18
Other Sources								
Fuel storage/handling[5]	0	0	0	0	0	0	0	0
Miscellaneous sources[6]	2	2	3	2	3	3	3	3
Total other sources	2	2	3	2	3	3	3	3
Total Airport Sources	64	64	67	72	69	92	91	95

Source: Massport

Notes: Years 2010 and 2013 were computed with previous years EDMS version to provide for a common basis of comparison. Years 2013 and 2014 were also computed with the previous year motor vehicle emission factors model.

kg/day - kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy); PM - particulate matter

1 It is assumed that all PM are less than 2.5 microns in diameter ($PM_{2.5}$). See *Appendix I, Air Quality/Emissions Reduction* for 2005 to 2009 emission inventory results.

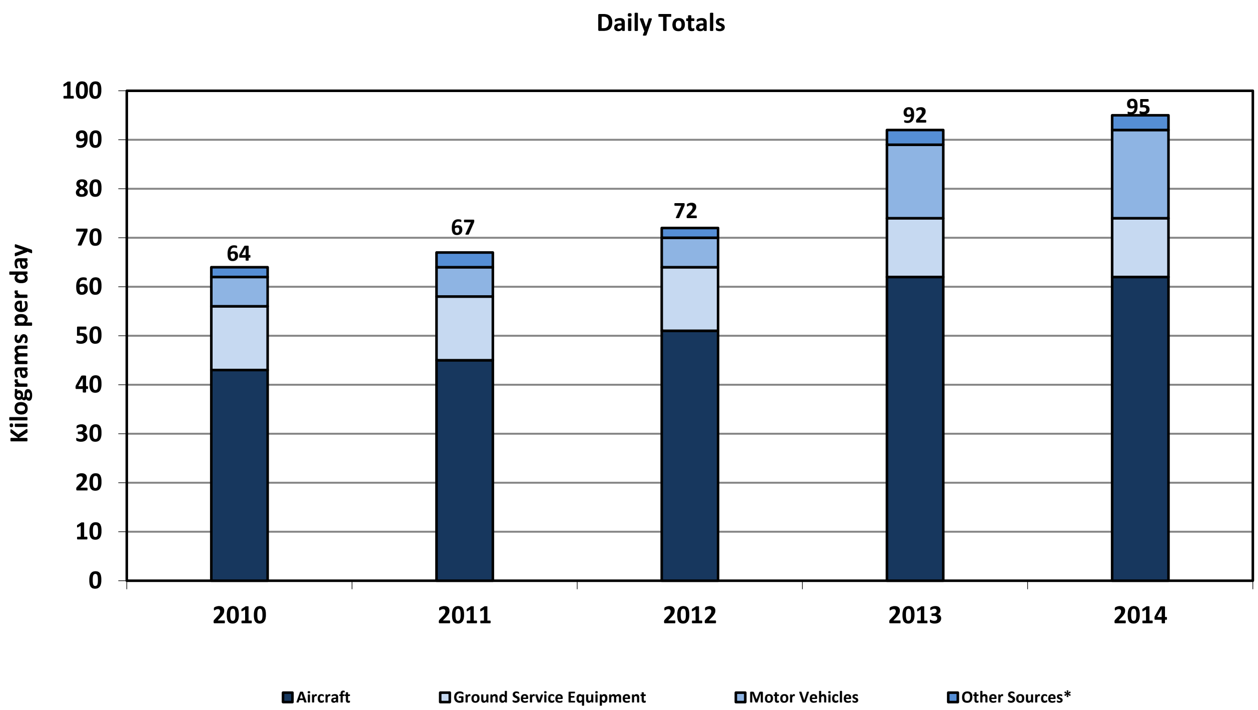
2 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.

4 Parking/curbside is based on VTM analysis.

5 Fuel storage and handling facilities are not sources of PM emissions.

6 Includes the Central Heating and Cooling Plant, emergency electricity generation, fire training, snow melters, and other stationary sources.

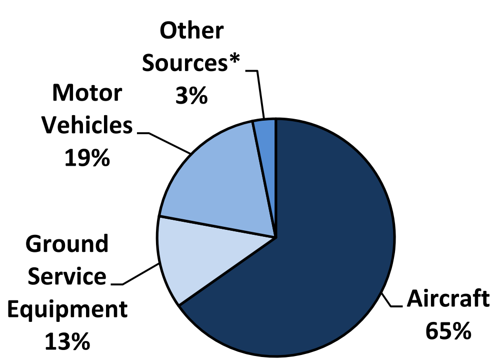
Figure 7-7 Modeled Emissions of $PM_{10}/PM_{2.5}$ at Logan Airport, 2010-2014



Note: The increase in emissions from 2012 to 2013 were primarily due to changes in the current EDMS and MOVES computer models.

* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.).

Figure 7-8 Sources of $PM_{10}/PM_{2.5}$ Emissions, 2014



* Other sources include stationary sources (e.g., Central Heating and Cooling Plant, snow melter usage, fire training, etc.)

Greenhouse Gas Assessment

GHGs are known to contribute to climate change (also known as global warming), although there is still some uncertainty regarding the global magnitude of this impact and the associated short- and long-term remedies. In April 2009, the EPA issued a proposed finding that GHGs also contribute to air pollution that may endanger public health or welfare. This action has laid the initial legal groundwork for the regulation of GHG emissions nation-wide under the CAA, although currently there are no specific U.S. laws or regulations that call for the regulation of GHGs for airports directly.[15] Current estimates of aviation-related GHG emission contributions to man-made totals range from 2 to 4 percent world-wide, and approximately 3 percent in the United States.[16,17]

In May 2010, the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) revised the *Massachusetts Environmental Policy Act (MEPA) Greenhouse Gas Emissions Policy and Protocol*.[18] Under the revised policy, certain projects subject to review under MEPA (though not specifically these annual *EDR*/*ESPR* filings) are required to:

- Quantify the GHG emissions generated by a proposed project; and
- Identify measures to avoid, minimize, or mitigate such emissions.[19]

With respect to the GHG emissions inventory[20] conducted for 2014, the following information is noteworthy:

- Even though the *2014 EDR* is not subject to the MEPA GHG policy, since it does not propose any discrete projects, Massport has voluntarily prepared an inventory of GHG emissions directly and indirectly associated with the Airport starting with the *2007 EDR*.
- The 2014 GHG emission inventory was again prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP).[21] The inventory assigns GHG emissions based on ownership or control (whether it is controlled by Massport, the airlines or other airport tenants, or the general public).
- For this assessment, the 2014 GHG emissions inventory includes aircraft operations within the ground-based taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle. GHG emissions associated with GSE/APU, motor vehicles, a variety of stationary sources, and electricity usage were also included.
- Massport has direct ownership or control over a small percentage of these GHG emission sources (i.e., Massport fleet vehicles, stationary sources, and electrical consumption within Massport buildings).

15 GHG emission reduction measures have been adopted by the EPA for new aircraft engines, but these regulations do not apply directly to airports.
16 Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York City, NY. November 2014.
17 U.S. Governmental Accountability Office (GAO), Aviation and the Environment, NextGen and Research and Development Are Keys to Reducing Emissions and Their Impact on Health and Climate, May 6, 2008.
18 Revised MEPA Greenhouse Gas Emissions Policy and Protocol, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 5, 2010.
19 These GHG are comprised primarily of carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), and three groups of fluorinated gases (i.e., sulfur hexafluoride [SF6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]). GHG emission sources associated with airports are generally limited to CO_2, CH_4, and N_2O.
20 This EDR GHG inventory is one of the three that Massport prepares annually; however, the other two comprise only stationary sources of GHGs and are filed with MassDEP and the EPA respectively. These reports are for Massport-owned and -operated equipment only, and do not cover any tenant owned/operated-equipment or facilities.
21 Transportation Research Board, Airport Cooperative Research Program, ACRP Report 11, Project 02-06, Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories. See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.

The vast majority of the emission sources are owned or controlled by the airlines, other airport tenants (such as rental car companies), and the general public (such as passenger motor vehicles).

- Massport also prepares two other GHG emissions inventories for stationary sources at Logan Airport:
  - A 2014 GHG emissions inventory for the MassDEP GHG Emissions Reporting Program for those sources meeting the criteria for Category 1 and Scope 1 (i.e., only those sources under the direct ownership and control of Massport);[22] and the
  - EPA Greenhouse Gas Summary Report.[23]

This EDR analysis followed the EEA guidelines and uses widely-accepted emission factors that are considered appropriate for airports, including International Organization for Standardization (ISO) New England electricity-based values. The analysis is also consistent with the ACRP guidance.

For the EDR, GHG emissions are segregated by ownership and control into Categories including: (1) emissions related to Massport activities were assigned to the Massport category; (2) emissions related to airport tenants were assigned to the tenant category; and (3) emissions related to the public, such as private automobiles, were assigned to the public category. These three categories (identified in Table 7-8) are also characterized by the degree of control that the airport operator (Massport) has over GHG emissions.

- Category 1 – GHG emissions from sources that are owned and controlled by the reporting entity (e.g., Massport). Category 1 typically represents sources which are owned by the entity - or sources which are not owned by the entity, but over which the entity can exert control. At Logan Airport, these sources include airport-owned and controlled stationary sources (e.g., boilers, generators, etc.), fleet vehicles, and purchased electricity. On-airport ground transportation and off-airport employee vehicle trips are included as Category 1 emissions as they are partly controlled by the airport.
- Category 2 – This category comprises sources owned and controlled by airlines and airport tenants, and include aircraft (i.e., on-ground taxi/idle and within the LTO up to 3,000 feet), GSE/APU, electrical consumption, and employee vehicles.
- Category 3 – This category generally comprises GHG emissions associated with passenger ground access vehicles. These include private automobiles, taxis, limousines, buses, shuttle vans, etc. operating on the off-airport roadway network.

Consistent with the ACRP guidelines, once the ownership categories are determined, the operational boundaries are also set, reflecting the Scope of the emission source (refer to Table 7-8) and include:

- Scope 1 /Direct – GHG emissions from sources that are owned and controlled by the reporting entity (e.g., Massport) such as stationary sources and airport-owned fleet motor vehicles.
- Scope 2 /Indirect – GHG emissions associated with the generation of electricity consumed, but generated off-site at public utilities.
- Scope 3 /Indirect and Optional – GHG emissions that are associated with the activities of the reporting entity (e.g., Massport), but are associated with sources that are owned and controlled by others. These include aircraft-related emissions, emissions from airport tenant's activities, as well as ground transportation to and from the airport.

22 Boston Logan International Airport, Massachusetts Department of Environmental Protection GHG Emissions Reporting Program, April 13, 2015.
23 U.S. EPA Greenhouse Gas Summary Report for Boston Logan International Airport for calendar year 2014.

Table 7-8 Ownership Categorization and Emissions Category/Scope

Owning/Controlling Entity Categories	Source	Category/Scope
Massport Owned and/or Controlled	Massport Fleet Vehicle	Category 1/Scope 1
	On-airport Ground Transportation	Category 1/Scope 1
	Off-airport Employee Vehicle Trips	Category 1/Scope 3
	On-airport Parking Lots	Category 1/Scope 1
	Stationary Sources (includes generators, boilers, etc.)	Category 1/Scope 1
	Fire Training	Category 1/Scope 1
	Electrical Consumption	Category 1/Scope 2
Tenant Owned and/or Controlled (includes airlines, government, concessionaires, aircraft operators, fixed-based operators, etc.)	Aircraft (on-ground, within the LTO up to 3,000 feet)	Category 2/Scope 3
	Auxiliary Power Units	Category 2/Scope 3
	Ground Support Equipment	Category 2/Scope 3
	Off-airport Employee Vehicle Trips	Category 2/Scope 3
	Electrical Consumption	Category 2/Scope 2
Public Owned and Controlled	Off-airport Vehicle Trips (Includes private automobiles, taxis, limousines, buses, shuttle vans, etc., operating on the off-airport roadway network)	Category 3/Scope 3

Source: Massport
Note: Follows Airport Cooperative Research Program (ACRP) guidance.
LTO Landing and Takeoff.

The GHG emissions inventory included in this *2014 EDR* is consistent with the data provided in the MassDEP and EPA GHG inventories for Logan Airport. However, the *2014 EDR* GHG emissions inventory is more comprehensive, as it covers all three scopes of GHG emissions including those from tenants and the public, which is consistent with ACRP guidance.[24] By comparison, the EPA GHG Reporting Program covers only stationary sources (i.e., Category 1 and Scope 1).

Table 7-9 presents the 2014 GHG emissions inventory, reported in CO_2 equivalent values.[25] As shown, Massport-controlled emissions represent only 13.0 percent of total GHG emissions at the Airport. By comparison, aircraft, GSE, and other tenant-based emissions represent 67.8 percent, purchased electricity represents 10.2 percent, and passenger ground access vehicle emissions represent 9.0 percent of total GHG emissions. Aircraft represent the largest source of emissions followed by motor vehicles and electricity generation as shown in Figure 7-9.

When segregated by Scopes, aircraft, GSE, and passenger vehicles (Scope 3) represent the largest source of GHG emissions at 77 percent, with electrical consumption (Scope 2) at 10 percent, and Massport-controlled sources (Scope 1) at 13 percent (refer to Figure 7-9). Overall, total GHG emissions associated with the Airport in 2014 were lower by 3 percent when compared to 2011 levels including aircraft GSE and other tenant-based emissions. Moreover, total GHG emissions in 2014 decreased by 1 percent from 2013 levels due partly to a decrease in passenger automobile traffic (on-Airport VMT) during this timeframe. Massport plans to continue to update this GHG Emissions Inventory for Logan Airport annually.

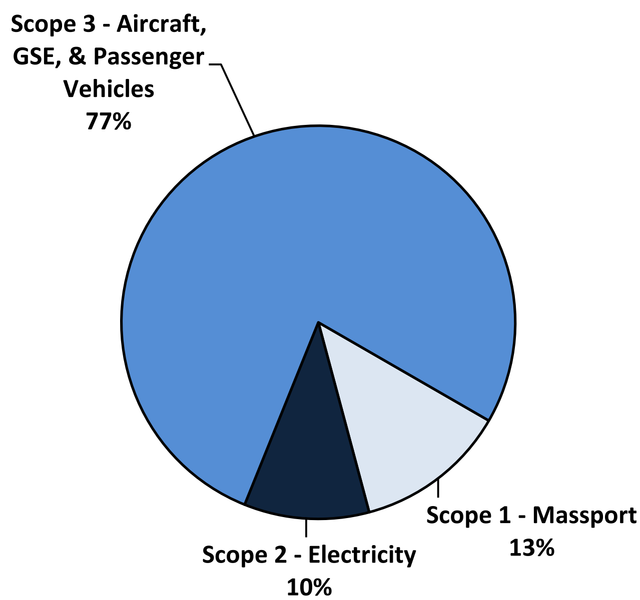
24 However, aircraft cruise mode emissions above the 3,000-foot LTO cycle were not included.
25 CO_2 equivalent values are based upon the Global Warming Potential values of 1 for CO_2, 25 for CH_4, and 298 for N_2O (based on a 100 year period) as presented in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, 2007.

Table 7-9 Estimated Greenhouse Gas Emissions Inventory (in MMT of CO_2eq) at Logan Airport, 2014[1]

Source	Category	Scope	CO_2	N_2O	CH_4	Totals
Massport-Controlled Emissions						
Ground Support Equipment[2]	1	1	<0.01	<0.01	<0.01	0.01
Massport Shuttle Bus	1	1	<0.01	<0.01	<0.01	<0.01
Massport Express Bus	1	1	<0.01	<0.01	<0.01	<0.01
On-Airport Roadways[3]	1	1	0.03	<0.01	<0.01	0.03
Off-Airport Roadways (Employees)[4]	1	3	<0.01	<0.01	<0.01	<0.01
Parking Lots	1	1	<0.01	<0.01	<0.01	<0.01
Stationary Sources[5]	1	1	0.03	<0.01	<0.01	0.03
Total Massport Emissions (13.0%)			**0.08**	**<0.01**	**<0.01**	**0.08**
Tenant Emissions						
Aircraft – Ground[6]	2	3	0.19	<0.01	<-[11]	0.19
Aircraft – Ground to 3000 feet[7]	2	3	0.17	<0.01	<0.01	0.17
Aircraft Engine Startup	2	3	<0.01	<0.01	<0.01	<0.01
Ground Support Equipment	2	3	0.01	<0.01	<0.01	0.01
Auxiliary Power Units	2	3	0.01	<0.01	-[11]	0.01
Off-Airport Roadways (Employees)[4]	2	3	0.02	<0.01	<0.01	0.02
Total Tenant Emissions (67.8%)			**0.40**	**<0.01**	**<0.01**	**0.41**
Purchased Electricity Emissions[8]						
Massport	1	2	0.01	<0.01	<0.01	0.01
Tenant and Common Area	2 and 3	2	0.06	<0.01	<0.01	0.06
Total Purchased Electricity Emissions (10.2%)			**0.06**	**<0.01**	**<0.01**	**0.06**
Passenger Vehicle Emissions						
Off-Airport Roadways[4]	3	3	0.05	<0.01	<0.01	0.05
Total Passenger Vehicle Emissions (9.0%)			**0.05**	**<0.01**	**<0.01**	**0.05**
Total Logan Airport Emissions[9]			**0.59**	**<0.01**	**<0.01**	**0.60**
Percent of Statewide Totals[10]			<1.0%	<1.0%	<1.0%	<1.0%

Source: Massport
1 MMT - million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O, and CH_4) in common units. Quantities are reported as “rounded” and truncated values for ease of addition.
2 Ground Support Equipment include the Logan Airport fleet. Emissions were calculated based on fuel usage.
3 On-airport roadways based on on-site vehicle miles traveled (VMT) and includes all vehicles.
4 Off-site roadways based on off-site Airport-related VMT and an average round trip distance of 60.5 miles (2010 Passenger Ground Access Survey).
5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters, and live fire training facility.
6 Aircraft – Ground emissions include taxi-in, taxi-out and ground-based delay emissions.
7 Aircraft – Ground to 3,000 feet include takeoff, climbout, and approach emissions up to a height of 3,000 feet (as specified by the ACRP guidance).
8 Emissions from electrical consumption occurs off-airport at power generating plants.
9 Total Emissions = Airport + Tenant + Public.
10 Percentage based on relative amount of total emissions to statewide total from World Resources Institute (cait.wri.org).
11 Contributions of CH_4 emissions from commercial aircraft are reported as zero. Years of scientific measurement campaigns conducted at the exhaust exit plane of commercial aircraft gas turbine engines have repeatedly indicated that CH_4 emissions are consumed over the full emission flight envelope [Reference: Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment, Santoni et al., Environ. Sci. Technol., July 2011, Volume 45, pp. 7075-7082]. As a result, the EPA published that: “…methane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers.” [Reference: EPA, Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines, May 27, 2009 [EPA-420-R-09-901], http://www.epa.gov/otaq/aviation.htm]. In accordance with the following statements in the 2006 IPCC Guidelines (IPCC 2006), the FAA does not calculate CH_4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. “Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines.” “Current scientific understanding does not allow other gases (e.g., N_2O and CH_4) to be included in calculation of cruise emissions.” (IPCC 1999).

Figure 7-9 Sources of GHG Emissions, 2014



Note: Scope 1 emissions are from sources that are owned or controlled by Massport, Scope 2 emissions are from electrical consumption, which are generated off-Airport at power generating plants, and Scope 3 emissions are from aircraft, GSE, and ground transportation to and from the Airport.

Table 7-10 provides a comparison between Airport-related GHG emissions from 2007 through 2014. Total GHG emissions in 2014 were slightly higher (7.1 percent) than 2010 levels. For ease of comparison to previous years, the 2014 emissions are summarized in a manner similar to previous years.

Table 7-10 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO_2eq) at Logan Airport – 2007 through 2014

Source	2007	2008	2009	2010	2011	2012	2013	2014
Direct Emissions[2]								
Aircraft[3]	0.22	0.21	0.19	0.18	0.19	0.19	0.19	0.20
GSE/APUs	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04	0.03	0.05	0.05
Other sources[5]	0.04	0.03	0.03	0.03	0.03	0.02	0.03	0.03
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28	0.26	0.29	0.29
Indirect Emissions[6]								
Aircraft[7]	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06	0.05	0.08	0.07
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08	0.08	0.06	0.06
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30	0.30	0.31	0.30
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58	0.57	0.60	0.60
Percent of State Totals[11]	<1	<1	<1	<1	<1	<1	<1	<1

Sources: Massport and KBE.
1 MMT – million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O and CH_4) in common units. Quantities are reported as “rounded” and truncated values for ease of addition.
2 Direct emissions are those that occur in areas located within the Airport’s geographic boundaries.
3 Direct aircraft emissions based engine start-up, taxi-in, taxi-out and ground-based delay emissions.
4 Direct motor vehicle emissions based on on-site vehicle miles traveled (VMT).
5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.
6 Indirect emissions are those that occur off the Airport site.
7 Indirect aircraft emissions are based on take-off, climb-out and landing emissions which occur up to an altitude of 3,000 ft., the limits of the LTO cycle
8 Indirect motor vehicle emissions based on off-site Airport-related VMT and an average round trip distance of approximately 60 miles.
9 Electrical consumption emissions occur off-airport at power generating plants.
10 Total Emissions = Direct +Indirect.
11 Percentage based on relative amount of Airport total of direct emissions to statewide total from World Resources Institute (cait.wri.org)

Air Quality Emissions Reduction

As part of implementing the ongoing air quality management strategy for Logan Airport, Massport has established a number of goals and objectives to address air emissions from Airport operations, including the minimization of Airport-related emissions, through the AQI and the reduction of GSE and Massport fleet emissions with AFV. This section presents an update on the AQI and the AFV Program at Logan Airport.

Air Quality Initiative (AQI)

Massport developed the AQI as a 15-year voluntary program with the overall goal to maintain NO_x emissions associated with Logan Airport at, or below, 1999 levels. The AQI has four primary commitments, shown below, along with Massport's progress in meeting the AQI commitments.

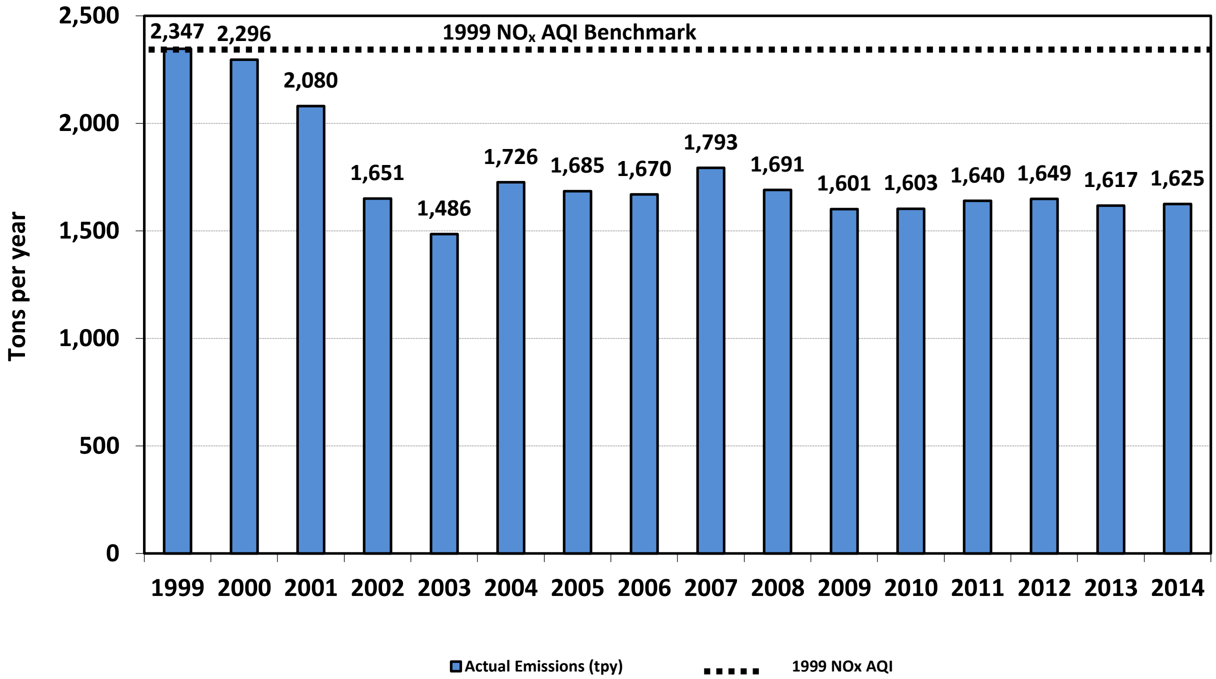
- **Expand on the air quality initiatives already in-place at Logan Airport.** See Table 7-14 for the initiatives in place at the time the AQI was developed.
- **As necessary to maintain NO_x emissions at or below 1999 levels, retire emissions credits, giving priority to mobile sources.** Massport updates the AQI inventory of NO_x emissions annually to reflect new information and changing conditions associated with the Airport's operations. Table 7-11 presents the updated NO_x emissions inventory and shows that, in 2014, again it was not necessary to purchase and retire mobile source emission credits to maintain NO_x emissions at, or below, 1999 levels.
- **Report the status and progress of the AQI in the ESPR or EDR.** Massport reports on the status of the AQI in the Logan Airport EDRs and ESPRs and has done so since 2001 (Table 7-11).
- **Continue to work at international and national levels to decrease air emissions from aviation sources.** Massport maintains memberships and active participation in a number of organizations involved in addressing aviation-related environmental issues, including air quality. These include serving on Environmental Committees of the American Association of Airport Executives (AAAE) and Airports Council International (ACI).

As shown in Table 7-11, NO_x emissions at Logan Airport in 2014 (net total with reductions) were approximately 722 tpy lower than the 1999 AQI benchmark. Since 1999, this trend represents a 31 percent decrease in 2014. Between 1999 and 2014, the greatest reductions of NO_x emissions were associated with aircraft, GSE, and on-Airport motor vehicles at 21 percent, 70 percent, and 87 percent reductions, respectively.

Figure 7-10 compares the 1999 AQI threshold level of 2,347 tpy of NO_x emissions to modeled NO_x emissions for 2001 through 2014. Cumulatively, and as of December 31, 2014, NO_x emissions at Logan Airport were approximately 9,417 tons below the benchmark set by the AQI. As shown in Table 7-10, based upon current projections, Massport expects that because the emission inventory is projected to be well below the 1999 threshold of 2,347 tpy through 2015, no credits will need to be purchased through the entire AQI timeframe.

The AQI was undertaken at a time when most emissions at Logan Airport were declining due to cleaner burning, more efficient internal combustion engines. NO_x emissions were, however, predicted to increase due to aircraft engine technologies. With the retiring of many older, less efficient aircraft after September 11, 2001, and the dramatic reduction in aircraft operations, the growth in NO_x emissions was never realized.

Figure 7-10 Modeled NO_X Emissions Compared to AQI[1]



1 Includes emission reductions from the use of alternative fuel vehicles, shuttle buses, and ground service equipment. See Table 7-11.

Table 7-11 AQI Inventory Tracking of Modeled NO_X Emissions (in tpy)[1] for Logan Airport

	Actual Conditions[2]						
	2000	2009	2010	2011	2012	2013	2014
Total Annual Emissions	2,315	1,609	1,608	1,647	1,654	1,627	1,628
Above (Below) 1999 Levels Before Reductions	(32)	(738)	(739)	(700)	(693)	(720)	(719)
Potential Reductions/ Increases[3]							
Alternative Fuel Vehicles/Shuttle Bus	(4)	(4)	(2)	(1)	0	(6)	0
Alternate Fuel Ground Service Equipment[4]	(14)	(4)	(3)	(6)	(5)	(4)	(3)
Total Potential Reductions	(19)	(8)	(5)	(7)	(5)	(10)	(3)
Above (Below) 1999 Levels After Reduction	(51)	(746)	(744)	(707)	(698)	(730)	(722)
Credit Trading[5]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Net Total w/Reductions and Credits	2,296	1,601	1,603	1,640	1,649	1,617	1,625

Source: Massport
Notes: Values in parentheses, such as “(250)” are negative values. Values without parentheses are positive values.
N/A Not available.
1 For consistency with the AQI, the NO_x emission values in this table are reported in tpy. The EDR/ESPR Emissions Inventory values are reported in kg/day. A conversion factor of 0.40234 is used to convert kg/day to tpy.
2 The 2009 analysis was completed using EDMS v5.1.2 and MOBILE6.2.03. The 2010 through 2012 analysis was completed using EDMS v5.1.3 and MOBILE6.2.03. The 2013 analysis was completed using EDMS v5.1.4.1 and MOVES2010b. The 2014 analysis was completed using EDMS v5.1.4.1 and MOVES2014.
3 Other initiatives that Massport and Logan Airport tenants may use for possible emission reductions include: Central Heating and Cooling Plant boilers, 400-Hz power at gates, and low NO_x fuels in Logan Express buses.
4 Massport’s current plan for the conversion of GSE to alternative fuels is being re-evaluated based on the new diesel rule (2007). GSE AFV credits were based on fuel type data obtained from the aerodrome vehicle permit applications beginning in 2007.
5 Since the AQI threshold is not exceeded in 2014, nor are the emissions expected to exceed the threshold in the near future, no credits will need to be purchased in the immediate term.

As part of the reporting process, the AQI also calls for an itemization of NO_x emissions generated by activities at Logan Airport according to the individual airline operator. Table 7-12 shows the estimated amounts of NO_x air emissions in 2014 generated by each airline in units of tpy and tons per LTO.

Based on Table 7-12, international carriers are the higher NO_x emitters per LTO because their longer stage lengths require aircraft equipped with larger and/or additional engines and heavier takeoff weights. Overall, international carriers emit 19 percent of the total aircraft NO_x emissions at Logan Airport in 2014. Other notable findings include:

- Carriers with the greatest number of flights tended to generate the highest percentage of total NO_x emissions;
- Combined, the four largest air carriers (by LTO), emitted 52 percent of the total aircraft NO_x emissions in 2014;
- Commercial airlines (excludes cargo and GA) accounted for 93 percent of total aircraft NO_x emissions in 2014;
- Cargo aircraft operators accounted for 6 percent of total aircraft NO_x emissions in 2014; and
- GA aircraft accounted for 1 percent of total aircraft NO_x emissions in 2014.

Table 7-12 Contribution of NO_X Air Emissions by Airline in 2014 (Estimated)

	Total Emissions (tons/year)		Normalized Emissions (tons/LTO)
Air Carrier, by Airline	LTOs	NO_X	NO_X per LTO
ABX Air	12	0.27	0.023
Aer Lingus	966	27.27	0.028
Air Canada[1]	5,737	13.19	0.002
Air France	450	25.08	0.056
Airtran Airways	1,721	12.00	0.007
Alaska Airlines	1,545	18.27	0.012
Alitalia	275	7.26	0.026
American Airlines[2]	11,316	145.70	0.013
Atlas Air	244	6.81	0.028
British Airways	1,339	95.59	0.071
Chautaugua	935	2.78	0.003
Copa	365	3.70	0.010
Delta Air Lines[3]	16,996	179.51	0.011
Emirates	301	12.46	0.041
Expressjet	1,791	5.82	0.003
FedEx	1,651	61.83	0.037
GA	13,235	19.83	0.001
GoJet	238	0.78	0.003
Hainan Airlines	140	3.74	0.027
Hyannis Air Service	17,540	0.48	<0.001
Iberia	166	5.51	0.033
Icelandair	614	12.99	0.021
Japan Airlines	366	9.77	0.027
JetBlue Airways	41,297	294.43	0.007
Lufthansa	857	34.35	0.040
Mesa	702	2.33	0.003
Miami Air	24	0.25	0.010
Mountain Air Cargo	23	0.02	0.001
Other Air Carrier	19	0.51	0.027
Other International	19	1.09	0.057
People Express	85	0.63	0.007
Peninsula Air	2,191	1.15	0.001
Porter Airlines	2,150	1.86	0.001
Republic Airlines	1,758	4.46	0.003
SATA International	267	4.56	0.017
Shuttle America	4,875	12.72	0.003
SkyWest	575	1.58	0.003
Southwest Airlines	9,262	87.39	0.009
Spirit	1,473	15.29	0.010
Sun Country	514	5.78	0.011
Swift Air	43	0.38	0.009
Swiss International	361	11.67	0.032
Turkish Airlines	225	7.49	0.033
TACV-Cabo Verde	93	1.63	0.018
Trans States	80	0.24	0.003
United Airlines	12,199	153.25	0.013
UPS Airlines	718	18.39	0.026
US Airways[4]	21,982	160.23	0.007
Virgin	358	13.88	0.039
Virgin America	1,599	16.27	0.010
Wiggins	207	0.03	<0.001
Total	181,899	1,522.52	0.008

Notes: Other International may include: AeroMexico, Saudi Arabian Airlines, etc.
The "Other" Categories may include airlines with less than 10 operations.
Normalized emissions are based on a Landing and Takeoff Cycle (LTO).
This list combines the major airlines with their commuters (i.e., Jazz with Air Canada, American Eagle with American Airlines, etc.).
Cargo carriers include: ABX, Atlas, FedEx, Mountain Air Cargo, UPS, and Wiggins.
GA – General Aviation

1 Includes Jazz.
2 Includes American Eagle.
3 Includes Delta Connection and Delta Shuttle.
4 Includes US Airways Express.

Alternative Fuel Vehicles Program

A component of Massport's Air Quality Management Program is the AFV Program. The AFV Program is designed to replace Massport's conventionally-fueled fleet with alternatively fueled or powered vehicles, when feasible, to help reduce emissions associated with Logan Airport operations. Massport now operates 99 vehicles powered by CNG, propane, E85 flex fuel, or operates hybrids powered by gasoline or diesel. Massport established a vehicle procurement policy in 2006 that requires consideration of AFVs when purchases are made. For example, beginning in 2013, as part of the Southwest Service Area (SWSA) redevelopment, the existing fleet of diesel rental car shuttle buses was replaced by CNG or clean diesel-electric hybrid buses. For 2014, five additional pick-up trucks powered by E85 flex fuel were acquired. Table 7-13 shows the number of Massport AFVs by vehicle type in 2014. As discussed in *Chapter 1, Introduction/Executive Summary,* several projects and programs support AFVs at Logan Airport including:

- The replacement of 94 diesel rental car buses and older CNG buses with a fleet of 50 alternative fuel (diesel-electric hybrids and CNG) buses, serves the new Rental Car Center (RCC), Massport terminals and other shuttle routes. This project was partially funded by the FAA's Voluntary Airport Low Emissions (VALE) Program grant. Four additional CNG buses were put into service in September 2015.
- Operation for almost two decades of one of the largest privately operated, publicly-accessible, CNG stations in New England, which in 2014, dispensed approximately 21,500 gasoline-equivalent gallons per month for Massport vehicles.
- The use of battery powered tugs and belt loaders for the Delta Air Lines ground service fleet at Terminal A.
- In 2012, Massport installed 13 electric vehicle charging stations to accommodate a total of 26 vehicles in the Central Garage and Terminal B parking areas. There are also two charging stations at the new Framingham Logan Express Garage.
- Renovation to the existing gas station in the North Cargo Area in 2008, which included the installation of an E85 (first-generation biofuel) fuel dispensing tank.
- Continued operation of Massport's "CleanAirCab" incentive program for AFVs, which allows hybrid or alternative fuel taxis to go to the head of the taxi line to serve passengers.

In addition, Logan Airport's new Green Bus Depot is designed to maintain the expanded CNG-fueled and clean diesel-electric hybrid shuttle bus fleet. Massport also began offering preferred parking for customers driving hybrid and AFVs in the spring of 2007.

Table 7-13 Massport's Alternative Fuel Vehicle Fleet Inventory at Logan Airport

Fuel Type	Vehicle	2014
Diesel/Electric Hybrid	Shuttle Bus[1]	32
Compressed Natural Gas (CNG)	Van	3
	Pick-Up Truck	5
	Honda Civic	9
	CNG NABI Bus[2]	18
Gasoline/Electric Hybrid	Ford Escape	8
Propane	Non-Road Vehicles (Forklifts)	2
E85 Flex Fuel	Pick-Up Truck	18
	Van	2
	Ford Escape	2
	Total	**99**

Source: Massport.
Note:
1 The 32 diesel/electric hybrid shuttle buses, added to the fleet in 2013, replaced the diesel rental car buses.
2 The CNG NABI buses replaced the 26 aging CNG shuttle buses.

Air Quality Management Goals

Massport's air quality management strategy for Logan Airport focuses on decreasing emissions, when feasible, from all Airport-related sources, in addition to studying innovative means to achieve emissions reductions. Massport's air quality improvement goals, the measures proposed to accomplish them, and some 2011/2012 milestones are listed in Table 7-14.

Massport continues to comply with the Logan Airport Parking Freeze[26], in accordance with 10 CMR 7.30 and 40 CFR 52.1135. For a discussion of Massport's compliance with of the Parking Freeze regulation, and the counterproductive effect of constrained parking at Logan Airport on VMT and attendant emissions, see *Chapter 5, Ground Access to and from Logan Airport*.

26 310 Code of Massachusetts Regulations 7.30 and 40 Code of Federal Regulations 52.1120.

Table 7-14 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2014 Status
Reduce emissions from Massport fleet vehicles	Convert Massport fleet vehicles to electricity or compressed natural gas (CNG) by retrofitting or procurement.	Massport uses the Energy Policy Act (EPAct) of 1992 to expedite Massport's Alternative Fuel Vehicle (AFV)/Alternative Power Vehicle (APV) program. In 2014, five additional pick-up trucks powered by E85 flex fuel were acquired.
Encourage use of alternative fuel and alternative power vehicles by private fleet and airside service vehicle owners	Provide infrastructure to support alternative fuels including CNG and electricity.	Massport continues to operate one of New England's largest retail CNG stations, which is open to the public. In calendar year 2014, the CNG station pumped approximately 21,500 gallon equivalents per month for all Massport fleet vehicles (non-Massport vehicles were also using CNG). Massport plans to support the current and future standard systems for plug-in electric vehicles (EVs). For example, the RCC in the Southwest Service Area (SWSA) includes the infrastructure necessary to accommodate future plug-in stations for electric vehicles. In 2012, Massport installed 13 electric vehicle charging stations to accommodate a total of 26 vehicles in the Central Garage and Terminal B parking areas. There are also two charging stations at the new Framingham Logan Express Garage.
	Work with ground access fleet and airside service-vehicle owners to encourage conversion.	Massport encourages conversion to AFVs/APVs by others through such policies as 50 percent discounts in AFV/APV ground access fees to limousines, vans, and buses; limited "front-of-line" taxi pool privileges to hybrid and AFVs/APVs; and preferred parking for hybrid and AFVs/APVs at Logan Airport parking facilities.
	Use of pre-conditioned air (PCA) at new and renovated terminals and terminal gates.	The majority of contact gates have PCA and/or 400-Hz power. This reduces the need for auxiliary power unit (APUs) and, consequently, reduces associated emissions. The recent improvements of Terminal B included the installation of PCA at all renovated gates.
Minimize emissions from motor vehicles	Implement a program to increase high occupancy vehicle (HOV) ridership by air passengers.	As described in detail in *Chapter 5, Ground Access to and from Logan Airport,* there are a number of HOV services serving Logan Airport that are aimed at air passengers, including the MBTA Blue Line and Sliver Line, Logan Express, and water transportation. Massport promotes the use of these services by employees, primarily through the Logan Airport Employee Transportation Management Association (Logan TMA) and various pricing incentives.
	Expand the Logan TMA for Airport employees.	Massport continues to provide commuting information to all Airport employees including Sunrise and Logan Express Shuttles with reductions in employee parking.
	Encourage employees to use bicycling as a mode of commuting.	Massport includes bike racks at all new facilities and at appropriate existing facilities to promote employees biking to work. Bicycle racks are currently provided at Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage, Signature general aviation facility, and the Green Bus Depot (Bus Maintenance Facility). Additional racks were installed at the RCC facility in 2014.

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2014 Status
Minimize emissions from Construction Equipment	Incorporate Clean Air Construction Initiative (CACI) into major earthwork construction projects.	For all construction projects, heavy construction equipment is required to be equipped with diesel particulate filters or diesel oxidation catalysts in accordance with CACI.
Reduce emissions from fuel vapor loss	Provide state-of-the-art fuel storage and distribution equipment.	The Fuel Storage and Distribution System is in operation.
	Implement Tank Management Program.	Refer to *Chapter 8, Water Quality/Environmental Compliance and Management*. Tank management focuses on proper maintenance.
Reduce emissions from stationary sources	Employ Reasonable Available Control Technologies (RACT) for NO_x at Central Heating/Cooling Plant.	RACT policies have been implemented.
	Use alternative fuels in snow melters.	Massport is required to use Ultra Low Sulfur Diesel (ULSD) fuel is used in all Massport snow melting equipment.
	Incorporate green building technologies and energy use reduction strategies.	Logan Airport has four U.S. Green Building Council Leadership in Energy and Environmental Design® (LEED) certified facilities. Terminal A (the first LEED certified terminal in the world), the Signature Flight Support GA Facility, the Green Bus Deport (LEED Silver certified), and the RCC (LEED Gold certified). Additionally, Terminal E features green building elements. An overview of sustainability initiatives is presented in *Chapter 1, Introduction/Executive Summary*.
	On-site renewable energy	Massport has installed and is planning to expand on-site renewable energy systems in the form of Solar Photovoltaic (Solar PV) panels and micro-wind turbines. Further details on these installations can be found in *Chapter 1, Introduction/Executive Summary.*

Table 7-14 Air Quality Management Strategy Status (Continued)

Air Quality Emissions Reduction Goals	Plan Elements	2014 Status
Reduce aircraft emissions	Work with the FAA to study and implement airfield-improvement concepts and operational changes that may have air quality benefits.	Massport promoted such concepts through the *Logan Airside Improvements Planning Project Environmental Impact Statement*, which recommended physical and operational improvements to Logan Airport including construction of the new Runway 14-32 and Centerfield Taxiway, and taxiway improvements. Runway 14-32 became operational in November 2006 and the Centerfield Taxiway was fully opened in summer of 2009. In addition, in coordination with Massport, the Massachusetts Institute of Technology (MIT) completed a detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing and issued a paper in March 2010, and in January 2011, MIT issued a paper on aircraft pushback control strategy to reduce congestion and taxi delay.
Reduce energy intensity and greenhouse gas emissions while increasing portion of Logan Airport's energy generated from renewable sources	Reduce energy consumption Increase the portion of Massport's energy being generated from renewable sources Reduce overall GHG emissions associated with energy consumed in Massport operated facilities at Logan Airport Reduce GHG emissions from Massport-operated mobile sources	This goal was identified as part of the Logan Airport Sustainability Management Plan (SMP)[1], which was released in April 2015. Progress on this goal will be reported on in annual sustainability reports.

1 Progress towards goals identified as part of the Logan Airport Sustainability Management Plan (SMP) will be reported separately, as part of Massport's annual sustainability reporting.

Updates on Other Air Quality Efforts

This section highlights other Logan Airport-related air quality efforts in 2014.

Massachusetts Department of Public Health Study

In 2004, the Massachusetts Legislature appropriated funds for the Department of Public Health (DPH) to undertake an assessment of potential health impacts of Logan Airport in the East Boston section of the city and any other communities located within a five-mile radius of the Airport, with a focus on noise and air quality. This study was completed in May 2014 and consists of an epidemiological survey combined with computer modeling of noise levels and air pollution concentrations. Massport has cooperated in this effort by providing funding to complete the study and Airport operational data in support of the study. In the spring of 2011, Massport also gave technical assistance in support of the DPH study by providing geographic information systems (GIS) analysis of the roadway network in and around Logan Airport in a format compatible with the FAA's EDMS. Massport is working with DPH and East Boston Health Center on implementing DPH recommendations related to Massport.

In response to the DPH study recommendations, Massport has:

- Entered into an agreement to provide funding to The East Boston Neighborhood Health Center to help expand the efforts of their Asthma and chronic obstructive pulmonary disease (COPD) Prevention and Treatment Program in East Boston and launch a program in Winthrop including screening children, providing asthma kits, and home visits, among others.
- Entered into an agreement with the Massachusetts League of Community Health Centers for the evaluation and assessment of the Asthma and COPD Prevention and Treatment Program, and engagement of community health centers in the North End, Charlestown, Chelsea, and South Boston. The East Boston Neighborhood Health Center will conduct the same evaluations for the East Boston and Winthrop community programs.
- Massport entered into an agreement with the MA DPH to expand or establish the Asthma and COPD Prevention and Treatment Program in South Boston, the North End, Chelsea, and Charlestown in collaboration with the Massachusetts General Hospital, South Boston Neighborhood Health Center, and conduct training on the Community Health Worker assessments.

The findings from this Study can be viewed from the DPH website at: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/investigations/logan-airport-health-study.html.

Massport Air Quality Monitoring Study

Massport has also completed a $1.6 million air quality monitoring study in and around Logan Airport in compliance with its MEPA Section 61 findings for the Centerfield Taxiway component of the Logan Airside Improvements Project. The study gathered air quality data in the communities around Logan Airport before and after the new Centerfield Taxiway became operational, with an emphasis on ambient (i.e., "outdoor") levels of particulate matter and hazardous air pollutants (HAPs). The intent of the study was to assess potential air quality changes related to the operation of the new taxiway. Massport worked cooperatively with MassDEP and DPH to develop the scope of the monitoring study.

Air monitoring commenced in 2007 at ten different stations located on and off the Airport. The monitoring comprised both "real-time" and "time-integrated" monitoring methods, and includes measurement of fine particulates, VOCs, carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). Massport also met periodically with MassDEP and DPH regarding the progress and results of the air monitoring.

The first year of the two-year study was completed September 2008 and the second phase concluded in September 2011 following the completion of the Centerfield Taxiway, which is now fully operational. The report is posted on Massport's website. For details on the study see Massport's website at: https://www.massport.com/environment/environmental-reporting/air-quality/centerfield-taxiway-study/

Single Engine Taxiing

Single engine taxiing is one measure that is being used by air carriers to help reduce fuel use and emissions. As a result, Massport supports the use of single engine taxiing, when it can be done safely, voluntarily and at the discretion of the pilot. Massport has conducted three surveys of Logan Airport air carriers (2006, 2009, and 2010) to understand the extent single engine taxiing is used at Logan Airport. In addition, Massport is an active member of the FAA Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program

on reducing noise and emissions. In 2009, Massport offered to facilitate a more detailed survey of pilots at Logan Airport by the Massachusetts Institute of Technology (MIT) to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010, which was provided in the *2009 EDR*. The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. MIT issued a paper in January 2011 reporting on a control strategy to minimize airport surface congestion, and thus taxiing time, by regulating the rate at which aircraft are pushed back from their gates. Also in January 2011, Massport sent a memorandum to air carriers in support of single engine taxiing when consistent with safety procedures. The memorandum highlighted best practices for single engine taxiing use based on the MIT survey findings. In May 2014, Massport sent an additional memoranda to air carriers in support of single/reduced-engine taxiing and the use of idle reverse thrust as strategies. Copies of these memoranda are provided in *Appendix L, Reduced/Single Engine Taxiing at Logan Airport Memoranda.*

MIT and the Center for Air Transportation Systems Research developed a methodology to account for single engine taxi procedures during the taxi-in or -out modes.[27,28,29] Some of the single engine taxi challenges noted in these studies include: (1) excessive thrust and associated issues; (2) maneuverability problems, particularly related to tight taxiways turns and weather; (3) problems starting the second engine; and (4) distractions and workload issues. Thus, pilots do not use single engine taxiing during each aircraft operation in practice, and when they do use it, it is not for the entire operation. Pilots use it even less often during taxi out.

When using the MIT methodology and available data (such as aircraft pilot surveys) applied to the most recent set of aircraft operational data for Logan Airport (i.e., 2014), the results show a savings of approximately 1,400,000 gallons of jet fuel and the reduction of approximately 13,900 metric tons of GHG emissions associated with this initiative.

Logan Airport Energy Planning

In 2009, Massport began preparing an Energy Master Plan for all Massport facilities. The planning process involved data collection and establishing regulatory targets and baselines. The Energy Master Plan will provide Massport with a comprehensive strategy to reduce energy use using a portfolio of achievable measures that will result in quantifiable energy savings and cost reduction. In 2010, the Massport Board approved the Energy Master Plan and approved funding to implement energy efficiency improvements.

Southwest Service Area Redevelopment Program

The principal feature of the SWSA Redevelopment Program is the new RCC and associated support facilities. The RCC consolidates on-airport rental car operations and facilities into one integrated user-friendly facility to better serve both the tenants and the traveling public, and reduce ground transportation and air quality impacts on-Airport and off-Airport in the surrounding neighborhoods. The RCC was designed, constructed and is according to Leadership in Energy and Environmental Design® (LEED) certification; the RCC was awarded LEED Gold certification in 2015 and meets the Massachusetts LEED Plus sustainable design and construction standards established by the Commonwealth’s Executive Office for Administration and Finance.[30]

27 A Survey of Airline Pilots Regarding Fuel Conservation Procedures for Taxi Operations, Massachusetts Institute of Technology.
28 Opportunities for Reducing Surface Emissions through Airport Surface Movement Optimization, Massachusetts Institute of Technology, 2008.
29 Analysis of Emissions Inventory for Single Engine Taxi-out Operations, Center for Air Transportation Systems Research.
30 According to Executive Order 484, titled “Leading by Example: Clean Energy and Efficient Buildings,” all new construction and significant renovation projects for state government buildings over 20,000 square feet must meet the Massachusetts LEED* Plus green building standard.

By constructing an on-site consolidated rental car facility, the RCC reduced the need for the rental car operators to shuttle vehicles from off-Airport storage locations, resulting in fewer on- and off-Airport VMT and lower air emissions (including mobile source GHG emissions) within the East Boston community, Route 1A, and adjacent neighborhoods. Through the implementation of the Unified Bus System, the new RCC facilitates the reduction of the current rental car shuttle bus fleet by 70 percent and the associated on-Airport VMTs, and air emissions. The Unified Bus System utilizes clean fuels (CNG and clean diesel-electric hybrid), further reducing emissions compared to the former rental car bus fleet. Also, the Unified Bus System includes combining the rental car shuttle bus service with existing Massport buses that service the Massachusetts Bay Transportation Authority (MBTA) Blue Line Airport Station (routes 22/33/55), resulting in further decreases to the size of the overall bus fleet serving the Airport, and reduced on-Airport VMT and air emissions. Other air quality benefits of the SWSA Redevelopment Program include the reduction of curb-side congestion at the main terminal complex through implementation of the Unified Bus System and reduced overall energy demand (and associated stationary source GHG emissions) through improved building energy design.

On May 28, 2010, the Secretary of EEA issued a Certificate that determined that the project adequately and properly complies with MEPA. *Chapter 3, Airport Planning* provides detail on the environmental and operational benefits of the SWSA Redevelopment Program related to the consolidation of ground transportation facilities and services, and traffic circulation and access improvements. Benefits of the consolidation will include customer service improvements, environmental management enhancements, reduced on-Airport VMT and the associated reductions in air emissions. RCC construction began in July 2010, starting with various enabling phases of construction and was completed in 2014.

Engagement in Aviation-Related Environmental Issues

Massport maintains memberships and active participation in a number of organizations involved in addressing aviation-related environmental issues, including air quality. These include serving on environmental committees for the Transportation Research Board, American Association of Airport Executives, and Airport Council International of North America.

Ultrafine Particles (UFP)

To date, there are no Massachusetts or Federal air quality standards for the emissions or the ambient levels of UFP due to limited health effects evidence and air quality data.[31] Future ESPRs/EDRs will report on UFP standards as they develop. The monitoring of UFP is being conducted at two airports in the U.S. but the data from these programs are preliminary and not necessarily adaptable to other airports. These UFP monitoring studies include the following:

- T.F. Green Airport (PVD) – Located in Warwick R.I., this UFP monitoring study is being conducted by the Rhode Island Airport Cooperation (RIAC) in accordance with state regulations. Under this multi-year program, UFP are being measured continuously at four sites located around the perimeter of the airport. Weather data (i.e., wind direction and speed) are also being collected. The UFP data from this program are provided to the Rhode Island Department of Environmental Management (RIDEM), but no findings or relationships to airport activity have been reported thus far.
- Los Angeles International Airport (LAX) – UFP were measured at this California airport as part of a research study undertaken by Los Angeles World Airports. In this study, UFPs were measured over two seasonal

31 National Ambient Air Quality Standards for Particulate Matter, Final Rule, "Federal Register 78:10 (15 January 2013) p. 3122.

campaigns at locations both on and off the airport property. Again, meteorological data were collected along with airport operational data as a means of evaluating the source(s) of the UFP. To date, this study found that UFPs in the vicinity of LAX result from the combined contributions from airport activities, motor vehicles traveling on the off-airport roadway network, nearby power plants, and from the transport of particles from other outlying sources.

Statewide, National and International Initiatives

Advancements on the national and international levels to decrease Airport-related air emissions have continued to focused primarily on three initiatives through the 2012 and 2013 time-periods: the advanced quantification of PM and HAPs emissions from aircraft engines; the continued phasing-in of AFV; and the implementation of GHG emissions reduction strategies. These initiatives are briefly described below.

- **Particulate Matter and Hazardous Air Pollutant Research—**Conducted by the FAA/National Aeronautics and Space Administration (NASA)/EPA and others, research continues to better characterize PM and HAPs emissions from aircraft engines. Similarly, air quality monitoring efforts at other airports were also conducted at various locations to advance what is known about ambient ("outdoor") levels of air pollutants in the vicinities of the nation's airports.[32] In addition to conducting its own air monitoring programs (Measured NO_2 Concentrations [*Appendix I, Air Quality/Emissions Reduction*]) and Massport Air Quality Monitoring Study [above]), Massport continues to closely track these issues through its involvement in aviation industry organizations such as ACI and AAAE.
- **Alternative Fuel Vehicle Conversions—**Airlines and other GSE users are continually replacing their older fossil-fueled vehicles and equipment with more fuel-efficient, low- and non-emitting (e.g., electric) technologies. Airport-fleet vehicles are also being converted to alternative fuels (e.g., propane). In response, GSE and automobile manufacturers are offering a wider selection of AFVs, many of which are designed specifically for airport use. Massport continues to support the conversion of fossil-fueled vehicles and equipment to alternative or lower-emitting fuels.
- **Participation in Massachusetts Climate Protection Plan—**Massport was one of 15 state agencies and authorities that participated in the development of the state's Climate Protection Plan: the Commonwealth's initial step towards reducing GHG. Massport is participating on two of the Plan's teams: Transportation System Planning and Transportation Technologies and Operations, with a focus in GHG emission reductions associated with Airport operations. Current reduction strategies include:
  - Include energy use and GHG emissions as criteria in transportation decisions;
  - Maintain and update public transit systems;
  - Expand programs to promote efficient travel;
  - Seek opportunities to reduce emissions at Logan Airport;
  - Improve aircraft movement efficiency;
  - Promote the use of cleaner vehicles and fuels in public transit fleets;
  - Continue to promote the use of clean diesel equipment on publicly-funded construction projects;
  - Eliminate unnecessary idling of buses; and
  - Advocate for aircraft efficiency at regional and national levels.

32 These air quality monitoring programs at other airports include T.F. Green Airport (Providence, R.I.); Los Angeles International and Santa Monica Airports in CA.

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Water Quality/ Environmental Compliance and Management

Introduction

The Massachusetts Port Authority's (Massport's) approach to environmental management and compliance is a key component of its commitment to sustainability and responsible stewardship at Logan Airport (refer to *Chapter 1, Introduction/Executive Summary* for details). Through monitoring and documentation, environmental performance is assessed, allowing policies and programs to be developed, implemented, evaluated, and continuously improved. Since 2006, Massport has had an International Organization for Standardization (ISO) 14001 certified Environmental Management System (EMS) in place. The EMS is a systematic approach that Massport uses to promote continual improvement of environmental management at Logan Airport. In 2015, Massport completed a comprehensive Sustainability Management Plan (SMP) for Logan Airport, which integrates with the existing EMS framework to promote continuous environmental improvement. The completion of the SMP demonstrates Massport's leadership and commitment to environmental stewardship.

Massport's primary water quality goal is to prevent or minimize pollutant discharges, thus limiting adverse water quality impacts associated with airport activities. Massport employs several programs to promote awareness of Massport and tenant activities that may impact surface and groundwater quality, thus improving water quality. Programs include implementing best management practices (BMPs) for pollution prevention by Massport, its tenants, and its construction contractors; training of staff and tenants; and a comprehensive stormwater pollution prevention plan. Massport complies with the Massachusetts Contingency Plan (MCP) by monitoring fuel spills and tracks the status of spill response actions. The MCP lays out a set of regulations that govern the reporting, assessment, and cleanup of spills of oil and hazardous materials in Massachusetts.[1] Massport also maintains a Tank Management Program, which includes a tank permitting, monitoring, upgrade, and replacement program. Information on Massport's Logan Airport Stormwater Pollution

1 310 Code of Massachusetts Regulations (CMR) 40.0000.

Prevention Plan (SWPPP)[2], Spill Prevention Control and Countermeasure Plan (SPCC)[3], and the MCP are provided in this chapter.

The federal Clean Water Act (CWA) requires permits for pollutant discharges into U.S. waters from point sources and for stormwater discharges associated with industrial activities. Massport holds permits under the U.S. Environmental Protection Agency's (EPA) and Massachusetts Department of Environmental Protection's (MassDEP) National Pollutant Discharge Elimination System (NPDES) Program. The NPDES permit covers Massport and its co-permittees at Logan Airport. It establishes effluent limitations and monitoring requirements for discharges from specified stormwater outfalls.

Massport is responsible for ensuring compliance with applicable state and federal environmental laws and regulations. Massport promotes appropriate environmental practices through pollution prevention and remediation measures. Massport also works closely with airport tenants and airport operations staff in an effort to improve compliance. Massport's environmental programs pertaining to water quality and environmental compliance and management include:

- Stormwater management;
- Water quality management;
- Fuel use and spills;
- MCP compliance;
- Storage tank compliance;
- Compliance auditing and inspections;
- Environmental Management System (EMS) implementation; and
- Clean State Initiative and Leading by Example Program participation.

2014 Water Quality/Environmental Compliance Highlights and Key Findings

The following summarizes the key water quality and compliance findings for 2014:

- International Organization for Standardization (ISO) 14001 certification for Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal) began in December 2006. In 2010, Massport expanded the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant), Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal), and Facilities III (Electrical and Structural). The most recent certification audit took place in June 2014, and a certificate was issued in July 2014; this certificate expires in July 2017.
- In 2014, there were 17 oil and hazardous material spills that required reporting to MassDEP, seven of which involved a storm drainage system.[4] Further details on spills can be found in the *Fuel Use and Spills* section of this chapter.

2 In accordance with the requirements of the current Logan Airport NPDES stormwater permit that was issued on July 31, 2007, Massport and its co-permittees were required to develop SWPPPs.
3 In accordance with the Clean Water Act, 40 CFR 112, *Oil Pollution Prevention*.
4 State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP.

- In 2014, 99 percent of samples were in compliance with standards (Table J-13). Out of 234 samples (inclusive of oil and grease, total suspended solids, and pH), 232 were at or below NPDES permit limits.
- Only two of the 234 samples in 2014 exceeded NPDES permit limits. One outfall sample out of a total of 24 samples at the West Outfall and one sample out of a total of 24 samples at the Maverick Street Outfall exceeded the regulatory limits of the NPDES Permit for total suspended solids (TSS) at the North, West, Northwest, Porter Street, and Maverick Street Outfalls. These exceedances were reported in August and April 2014, respectively, as required. Massport's SWPPP addresses stormwater pollutants in general and also addresses deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other sources of stormwater pollutants. The 2014 Annual Certificates of Compliance were submitted to EPA and MassDEP on December 18, 2014, for Massport and each tenant co-permittee.
- In accordance with the MCP, Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. Massport is working towards achieving regulatory closure of the remaining Logan Airport MCP sites associated with known releases, as well as addressing sites encountered during construction. Progress has been made for all MCP sites with updates included in Table 8-4.

ISO 14001 Certified Environmental Management System

The ISO 14001 certified EMS is a systematic approach that Massport uses to promote continual improvement of environmental impacts at Logan Airport. The goals of Massport's EMS are to meet regulatory requirements and to improve Massport's environmental performance beyond compliance on an ongoing basis.

The EMS consists of policies, procedures, and records that collectively are used by Massport employees to prevent pollution and address potential environmental impacts associated with airport operations. Responding to environmental regulations and international standards, Logan Airport's EMS provides a structure for regulatory compliance and monitoring of a wide range of activities at the Airport that affect the environment, such as air quality, recycling, stormwater pollution prevention, and energy use.

Logan Airport's EMS is independently certified to the ISO 14001:2004 international standard. Certification for Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal) began in December 2006. In 2010, Massport expanded the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant), Facilities II (Vehicle Maintenance, Landscaping, and Snow Removal), and Facilities III (Electrical and Structural). The most recent certification audit took place in June 2014, and a certificate was issued in July 2014; this certificate expires in July 2017.

Stormwater Management in 2014

On July 31, 2007, EPA and MassDEP issued an individual NPDES Stormwater permit for Logan International Airport (NPDES Permit MA0000787). The new permit became effective on September 29, 2007, replacing the previous NPDES Permit dated March 1, 1978. The NPDES permit is on EPA's website at: www.epa.gov/NE/npdes/logan/pdfs/finalma0000787permit.pdf. Massport holds a separate NPDES permit for the Fire Training Facility (NPDES Permit MA0032751). The following sections describe the requirements of the two permits, and Massport's compliance with these requirements.

Stormwater Outfall NPDES Permit Requirements and Compliance

The following sections describe stormwater outfalls that are subject to the NPDES Permit, the monitoring requirements, and the monitoring results for 2014.

Outfalls Subject to the NPDES Permit

The NPDES permit regulates stormwater discharges from the North, West, Northwest, Porter Street, and Maverick Street Outfalls, and all of the airfield outfalls. The areas drained by the outfalls are the North Drainage Area (152 acres); West Drainage Area (560 acres); Northwest Drainage Area (23 acres); Porter Street Drainage Area (127 acres); Maverick Street Drainage Area (40 acres); and the Airfield Outfall Drainage Areas (A1 through A44), which drain the remainder of the airfield including runways, taxiways, and the perimeter roadway (910 acres). The North and West Drainage Areas also drain a portion of the airfield. These drainage areas are shown in Figure 8-1 and further described in Table 8-1. The North and West Outfalls have end-of-pipe pollution control facilities to remove debris and floating oil and grease from stormwater prior to discharge into Boston Harbor.

Table 8-1 Stormwater Outfalls Subject to NPDES Permit Requirements

Outfall Name and Number	Drainage Area (Acres)	Boston Harbor Discharge Location	Major Land Uses
North (001)	152	Wood Island Bay	Terminal E, apron, taxiway, cargo areas, fuel farms, and runways
West (002)	560	Bird Island Flats	Taxiways, terminal areas, aprons, cargo areas, runways, and roadways
Porter Street (003)	127	Bird Island Flats	Hangars, vehicle maintenance facilities, cargo areas, car rental facilities, and
Maverick Street (004)	40	Jeffries Cove	Car rental facilities, bus/limousine pools, parking areas
Northwest (005)	23	Wood Island Bay	Flight kitchen, bus maintenance facility
Airfield (A1 through A44)[1]	910	Perimeter of Airfield	Runways, taxiways, and perimeter roadway

Source: Massport

1 In accordance with the requirements of the NPDES permit, Massport developed an Airfield Stormwater Outfall Sampling Plan (March 27, 2008). The Plan requires quarterly wet weather sampling at a minimum of seven of the airfield outfalls (A1 through A44) to obtain representative samples of the quality of stormwater runoff from the airfield.

Monitoring Requirements
The NPDES permit requires grab samples (single samples collected at a particular time and place) to be taken monthly from the North, West, Porter Street, and Maverick Street Outfalls. Samples are tested for pH, oil and grease, TSS, benzene, surfactants, fecal coliform bacteria, and *Enterococcus* bacteria during both wet and dry weather. Grab samples are also taken quarterly from these four outfalls during wet weather to test for eight different polycyclic aromatic hydrocarbons (PAHs).

Additional sampling requirements of the NPDES permit include sampling for deicing compounds twice during the deicing season (October through April) at the North, West, and Porter Street Outfalls. The NPDES permit sets discharge limitations for pH, oil and grease, and TSS from the North, West, and Maverick Street Outfalls and for pH from the Porter Street Outfall. The NPDES permit does not include any discharge limitations for the Northwest Outfall, airfield outfalls, or the deicing monitoring, and requires only that the sampling results be reported. *Appendix J, Water Quality/ Environmental Compliance and Management* contains additional information on the sampling requirements of the NPDES permit.

Monitoring Results
Ninety-nine percent of samples were in compliance with standards (Table J-13). Out of 234 samples (inclusive of oil and grease, total suspended solids, and pH), 232 were at or below NPDES permit limits.

During 2014, one out of 21 stormwater samples collected from the West Outfall and one out of 19 stormwater samples collected from the Maverick Street Outfall exceeded the limit for TSS established in the NPDES permit. The 2014 TSS exceedance at the West Outfall occurred on August 13, 2014 and the TSS exceedance at the Maverick Street Outfall occurred on April 15, 2014.

A wet weather sample collected at the Maverick Street Outfall on April 15, 2014, had a TSS concentration of 130 milligrams per liter (mg/L) which exceeded the 100 mg/L daily maximum limit for TSS. A wet weather sample collected at the West Outfall had a TSS concentration of 250 mg/L.

Field staff noted that the sample from the Maverick Street Outfall was gray and contained suspended solids. Massport was immediately notified of the exceedance upon receipt of the laboratory results. Prior to the April 15, 2015 sampling event, there had been six days of dry weather followed by a significant amount of rain (0.62 inches) on the day of sampling, which may have contributed to the TSS concentration. The TSS concentration at the Maverick Street Outfall collected the next week on April 21, 2014 during the dry weather event was below the Permit limit at 31 mg/L, and the sample was observed to be clear and free of suspended solids.

TSS was measured above the permit limit of 100 mg/L at a concentration of 250 mg/L in the wet weather sample collected from the West Outfall on August 13, 2014. Field staff noted that the sample had a gray tint and contained some black suspended solids. Prior to the August 13, 2014, sampling event, there had been 15 days of dry weather followed by a significant amount of rain (1.06 inches) on the day of sampling, which may have contributed to the TSS concentration.

In 2014, there were no TSS exceedances reported at the North Outfall. The highest concentration of TSS observed at the North Outfall was 87 mg/L, which occurred on February 13, 2014. There were no other exceedances for the other NPDES permit discharge limits in 2014, which include oil and grease and pH.

Figure 8-1 Logan Airport Outfalls

Source: Aerial photo, Massport

The NPDES permit requires only that sampling results be reported for the Porter Street, Northwest Outfall and airfield outfalls, and the permit does not contain discharge limits for these outfalls. In 2014, the highest average concentrations observed at the Porter Street Outfalls were 310 mg/L of TSS (February 13, 2014) and 22 mg/L of oil and grease (February 13, 2014). In 2014, the highest concentration of TSS observed at the Northwest Outfall was 68 mg/L (December 9, 2014). Oil and grease was not measured above the laboratory detection limit (<4.0 mg/L) in any of the samples collected from the Northwest Outfall in 2014. The highest average concentrations observed at the airfield outfalls were 36 mg/L of TSS (June 4, 2014) and 0 mg/L of oil and grease (all samples below laboratory detection limit of <4.0 mg/L).[5]

Deicing sampling at the North, West, Porter Street, and airfield outfalls occurred during wet weather in February 2014. Sampling results are reported as required by the EPA and MassDEP (see Table J-12 in *Appendix J, Water Quality/ Environmental Compliance and Management)*.[6]

The NPDES water quality monitoring results are posted on Massport's website (http://www.massport.com/environment/environmental-reporting/water-quality/monitoring-results/), and Massport provides copies of the monitoring results to EPA and MassDEP.

Due to the large size of the drainage areas and relatively low concentration of pollutants, it is not always possible to trace exceedances to specific events. Where a known event such as a spill is reported, Massport routinely checks the drainage system for impacts from the event and takes corrective actions if necessary. The 2014 water quality monitoring results for discharge from the outfalls is provided in *Appendix J, Water Quality/ Environmental Compliance and Management* along with the history of water quality monitoring results that dates back to 1993.

Stormwater and Sanitary Sewer System Inspections and Repairs

Between 2006 and 2008, Massport conducted inspections of the sanitary sewer and stormwater drainage system serving Logan Airport to document the condition of the systems and identify potential impacts from the sewer to the stormwater drainage system. Such impacts could result from leaks or breaks from the sanitary sewer or from direct, inadvertent, illegal cross-connections to the stormwater drainage system. As a result of these surveys, the Boston Water and Sewer Commission (BWSC) completed replacement of sections of the sanitary sewer during 2009 and 2010.

The sanitary sewer inspections identified deficiencies in the sewer maintained by Massport at several locations throughout the Airport. Massport retained the engineering services of a consulting engineer to review the sewer investigation report, supplement the investigations, design sewer line repairs to address the deficiencies, and prepare construction documents. In 2012, the consultant completed cleaning and camera inspection of the system and identified additional sections of sewer line that required repair.

Construction bid documents for the sewer repair work were completed in July 2013. The work was completed in November 2013 at a total cost of approximately $550,000, which includes engineering and construction costs. The nature of the repairs and locations are listed in Table 8-2.

5 The 2007 NPDES permit does not set maximum daily discharge limitations for the Runway/Perimeter Stormwater Outfalls.
6 Wet weather deicing monitoring was only required during the first and third year of the NPDES permit.

Table 8-2 Sewer Repair Work and Locations

Location	Repairs
Lovell Street	300 linear feet (LF) of cured-in-place liner; repair MH brickwork
Facilities III Parking Lot	165 LF of cured-in-place liner; clear intruding taps
U.S. Air Hangar Parking Lot	Excavate and replace 240 LF of pipe
Airside near Facilities II and U.S. Air Hangar	375 LF of cured-in-place liner
Airside near Signature Ramp	410 LF of cured-in-place liner
Airside near Signature Ramp	Grout-in-place sleeve for spot repair
Arrivals Roadway near West Garage	105 LF of cured-in-place liner
Terminal C	Grout-in-place sleeve at three locations; 170 LF of cured-in-place liner

Source: Massport

In 2014, Massport's Facilities Department conducted inspections and cleaning of manhole and catch basin structures at locations throughout the Airport. In accordance with Part I.B.10.h of the Logan Airport NPDES Permit, the inspection and cleaning activities focused on structures within 100 yards of aircraft, vehicle, and equipment maintenance facilities. A total of 300 manhole and catch basin structures were inspected in 2014. Sediment depths were recorded and the sediment was then removed, as necessary, from the structures. Approximately 10 percent of the structures required cleaning. A total of approximately 20 cubic yards of sediment and debris was removed during cleaning of the structures in 2014. In addition to the inspection and cleaning of manhole and catch basin structures, Massport's Facilities Department is responsible for inspecting and cleaning 52 water quality control structures (i.e., stormceptor units). The units were inspected and cleaned twice in 2014, during the months of May and November. The condition of the units was documented and any accumulated sediment or debris was removed.

Bacteria Source Tracking

Massport continues to monitor bacteria levels at stormwater outfalls by obtaining samples during wet weather and dry weather sampling events for laboratory analysis. Review of the analytical data indicates that bacteria levels continue to be highly variable, with no consistent trends that would indicate an ongoing source such as a cross-connection to a sanitary sewer line. Sampling results are available in *Appendix J, Water Quality/Environmental Compliance and Management.*

On October 29, 2014, Massport met with the EPA, MassDEP, and the Division of Marine Fisheries (DMF) as part of the NPDES Permit renewal process. During the meeting, Massport reviewed the Comprehensive Sewer Investigation and the sewer repairs that were completed following the investigation. The results of ongoing bacteria monitoring at stormwater outfalls were also reviewed. The monitoring data are included in the Discharge Monitoring Reports submitted to the EPA in accordance with the NPDES Permit.

Massport has continued to track the development of bacteria source tracking technologies and evaluate the appropriateness of additional testing.

Fire Training Facility NPDES Permit Requirements and Compliance

NPDES Permit No. MA0032751[7] regulates treated wastewater from the Fire Training Facility on Governors Island (Figure 8-1). The treated wastewater from fire training exercises is stored, treated by separation and a carbon filter to remove fuel contaminants, and is typically beneficially reused onsite to recharge the fire training pit. If no storage is available, treated wastewater is tested prior to discharge to the storm sewer to ensure compliance with the Fire Training Facility's NPDES Permit. Discharge monitoring reports are submitted monthly to EPA. In 2014, Massport reused all but approximately 17,600 gallons of wastewater generated at the Fire Training Facility. The excess water was shipped off-site for disposal at an appropriately permitted facility.

Fuel Use and Spills in 2014

Management of fueling operations at Logan Airport is designed to minimize impacts on water quality by implementing Stormwater Pollution Prevention BMPs, including the use of reliable storage, secondary containment, and effective spill cleanup procedures. Massport's jet fuel storage and distribution infrastructure, installed in 2000 and 2001, includes a zoned leak detection system for underground fuel piping, which identifies volumetric changes of product in the pipe at operating pressure and zero pressure. The system combined the storage facility with a hydrant fuel system that reduced the need for trucks and dispensing. The former fuel farms were removed in 2000.

The fuel storage and distribution system was designed to ensure, to the extent technologically feasible, the reliable detection of leaks. The above ground jet fuel storage facility and distribution system are leased and operated by a single party, BOSFUEL, an airline consortium. The management of the facility by one entity was put in place to minimize potential fuel spills and maximize water quality protection for the storage and distribution facilities. Cathodic protection, leak detection, secondary containment, and tank overfill protection methods such as alarms, inventory gauging sensors in the tanks, and emergency fuel shut-off systems have been installed. The operation and maintenance of these controls have been included in the Operation and Maintenance Manual used by BOSFUEL's contractor to operate and maintain the facility. Built-in environmental controls, unified operations, and the ongoing contingency planning provide heightened environmental protection and more efficient fuel handling operations than the previous system. In 2010, BOSFUEL, in coordination with Massport, completed the replacement of the portion of the jet fuel distribution system that had not been part of the fuel storage and distribution system improvements completed in 2001. The fuel line replacement, which began in 2008, involved the installation of approximately 6,500 linear feet of pipe in the vicinity of Terminals B and C.

The Massport Fire Rescue Department keeps logs of all spills at Logan Airport (see Table 8-3). State environmental regulations require that oil spills of 10 gallons or more in volume be reported to MassDEP. Spills that enter storm drains of any volume must also be reported to Massport. During 2014, seven of the fuel spills entered the storm drainage system. Massport keeps records of all spills, including those less than the reporting threshold. In 2014, of the oil and hazardous material spills reported to the Massport Fire Rescue Department, 17 spills (13.2 percent) were reportable, due to their volume. Of the 17 reportable spills in 2014, commercial airlines were responsible for nine of the spills; Massport was responsible for three of the spills; three spills were the result of aircraft fueling; a private aircraft was responsible for one spill; and one spill was the result of construction. By volume, jet fuel spills accounted for 28.2 percent of total fuel spilled; hydraulic oil

7 NPDES Permit No. MA0032751 - *Logan International Airport Fire Training Facility*. Issued November 1, 2006.

accounted for 3.5 percent; diesel fuel accounted for 65.0 percent; gasoline accounted for 0.3 percent; and other fuels accounted for 3.0 percent. A summary of Logan Airport jet fuel usage and spill records from 1990 to 2014, and greater detail pertaining to type and quantity of the spills can be found in *Appendix J, Water Quality/Environmental Compliance and Management*.

Table 8-3 Logan Airport Oil and Hazardous Material Spills[1] and Jet Fuel Handling

Year	Total Number of all Spills	Total Number of all Spills >10 gallons	Total Volume of all Spills (Gallons)	Estimated Volume of Jet Fuel Handled (Gallons)	Total Volume of Jet Fuel Spilled (Gallons)
2004	126	18	894	373,996,141	574
2005	97	15	2,319	368,645,932	585
2006	92	11	752	364,450,864	644
2007	108	7	604	367,585,187	361
2008	99	20	944	345,631,788	662
2009	95	6	1,004	327,358,619	915
2010	87	15	476	335,693,997	360
2011	108	12	572	340,421,373	337
2012	132	5	593	343,731,127	439
2013	94	6	452	349,397,940	351
2014	129	17	2,785	370,222,342	785

Source: Massport Fire Rescue Department and Massport Environmental Management Department.
Notes: Oil and hazardous material spills and jet fuel handling data from 1990 through 2014 is provided in *Appendix J, Water Quality/Environmental Compliance and Management*.
1 Materials include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.

Tank Management Program

Since 1993, Massport has had a Tank Management Program in place that is designed to ensure that all Massport-owned tanks are in regulatory compliance with federal and state tank regulations. From 1993 through 2005, Massport completed six construction phases of storage tank modifications that included removal, replacement, and upgrades to existing tanks and the related piping systems to comply with federal and state tank regulations. In 2009, Massport installed a remote tank monitoring system for heating oil underground storage tanks (USTs) to allow for continuous monitoring of inventory levels, as well as leak detection. As a BMP, Massport continues to monitor tank systems and upgrade facilities, as needed.

In 2014, Massport and its tenant tank owners continued to comply with new state storage tank regulations.[8] These new regulations transferred jurisdiction of all USTs from the Department of Fire Services (DFS) to MassDEP. Jurisdiction of all aboveground storage tanks (ASTs) with capacity volumes greater than 10,000 gallons remains with the DFS, and those ASTs with less than a 10,000-gallon capacity are now under local (Massport Fire Department) jurisdiction. There are three ASTs at Logan Airport with volumes greater than 10,000 gallons; two of these tanks are located in the North Service Area, and contain glycol; and the third tank is located at the Central Heating Plant, and is used for storage of heating oil. Compliance with the new tank regulations included the following:

8 527 Code of Massachusetts Regulations (CMR) 9.00.

- Re-permitting all ASTs using a newly created Massport Fire Department annual permit;[9] and
- Updating and tracking of AST permit status, using the Massport AST database.

Massport is also implementing a successful tank release prevention strategy, which includes:

- A continuing program of monthly inspections, testing, and minor repairs of all Massport-owned tanks, related piping, and tank monitoring systems. Annual Stage II Vapor Recovery testing was conducted in May 2014, for Massport's USTs and piping systems at four facility locations. Stage II Vapor Recovery Systems collect gasoline vapors from vehicles' fuel tanks when customers dispense gasoline products into their vehicles at gasoline dispensing facilities. The Stage II system uses special nozzles and coaxial hoses at each gasoline pump to capture vapors from vehicle fuel tanks during the refueling process and reroute them to the station's storage tank(s). Testing included replacement of defective hoses and/or nozzles, as needed.
- Annual DFS inspections of all three of Massport's ASTs greater than 10,000-gallons in volume, and submittal to MA Department of Fire Services.
- Review of all proposed tenant tank upgrades, installations, and tank removals (under Massport's Tenant Alteration Application process) to ensure compliance with applicable state and federal regulations and with Massport policy.
- Ongoing upgrade and maintenance of a database that contains information on all USTs located on Massport property. For each tank, the database tracks location, permit status, compliance status with applicable tank regulations, and tank and monitoring system equipment summaries. Information on ASTs is kept in a separate database which was developed in 2010.
- Massport also provides tenants with information regarding the revised storage tank regulatory requirements and offers assistance with tenants' tank permitting procedures.

Site Assessment and Remediation

The MCP (310 Code of Massachusetts Regulations 40.0000), which is administered by the MassDEP, pertains to releases of oil or hazardous materials into the environment. The MCP prescribes the site cleanup process based on the nature and extent of a release's contamination. The MCP defines the roles for those parties affected by and potentially responsible for the release and establishes the release reporting program and submission deadlines for tracking events from initial release to regulatory closure.

In accordance with the MCP, Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. There are a number of phases for the investigation of contaminated sites. Phase I involves initial site investigations for the presence of contamination and Phase II assessments are more comprehensive site investigations. Phase III identifies, evaluates, and selects remediation actions and Phase IV involves the implementation of selected remedial actions. Phase V involves the operation, maintenance and/or monitoring of the remediation program. Massport leads the performance of a variety of response actions, including remediation at sites where Massport is the responsible party, where there are multiple responsible

9 Although ASTs with a capacity of less than 10,000-gallons is no longer under the jurisdiction of the Massachusetts DFS, the ASTs are still subject to the Massachusetts fire regulations and therefore must obtain an annual permit through the Massport Fire Department which has jurisdiction over the less than 10,000-gallon ASTs. ASTs with capacity of over 10,000-gallons also need to obtain this annual permit before those tank owners may obtain a permit from DFS.

parties, and where no responsible party has been identified. Table 8-4 describes Massport's progress in 2014 in achieving regulatory closure of the MCP sites identified in Figure 8-2.

Figure 8-2 Massachusetts Contingency Plan Sites

Note: Refer to Table 8-4 for the numbered projects.

Table 8-4 MCP Activities Status of Massport Sites at Logan Airport	
Location (Release Tracking Number) and MassDEP Reporting Status	**Action/Status**
1. Fuel Distribution System (3-1287) (continued)	
2010	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2009 and September 2010. A RAM Completion Report for the BOSFUEL Project was submitted in February, and the report was revised in March 2010.
2011	A Periodic Review of the Temporary Solution for the FDS was submitted in April 2011. Additionally, three Post-Class C RAO Status Reports were submitted for the FDS in February, June, and December 2011, summarizing the routine inspection and monitoring activities.
2012	Post-Class C RAO Status Reports were submitted in May and November 2012, summarizing the routine inspection and monitoring activities.
2013	Post-Class C RAO Status Reports were submitted in May and November 2013, summarizing the routine inspection and monitoring activities.
2014	Post-Class C RAO Status Reports were submitted in May and November 2014, summarizing the routine inspection and monitoring activities. In addition, a RAM Plan was submitted in April 2014 to address construction in the area of the FDS followed by a RAM Completion Report submitted in August 2014.
2. North Outfall (3-4837)	
2010	No change in status.
2011	No change in status. Massport provided updated data for the MassDEP website.
2012	Response Action Outcome submitted to DEP on December 27, 2012. No further MCP response action is required.
3. Former Robie Park (3-10027)	
2010	Two Remedy Operation Status Reports were submitted on September 29, 2010 and March 28, 2011. The next status report was scheduled for September 30, 2011.
2011	Phase IV Project Status Reports 2 and 3 were submitted in March and September 2011, respectively.
2012	Phase V Status Reports 4 and 5 were submitted in March and September, 2012, respectively.
2013	Phase V Status Reports 6 and 7 were submitted in March and September, 2013, respectively.
2014	Phase V Status Reports 8 and 9 were submitted in March and September, 2014, respectively.
4. Former Robie Property (3-23493)	
2010	A Class A-3 RAO was submitted on January 4, 2010, corresponding with the recording of an AUL. On May 21, 2010, a RAM Plan for the Economy Parking Structure was submitted. The first RAM Status Report was submitted on September 21, 2010. An AUL Amendment was recorded on December 9, 2010.
2011	A RAM Completion Statement was submitted on March 15, 2011. Regulatory closure has been achieved. No further response actions are required.
5. Tomahawk Drive (3-27068)	
2010	No further response actions were required.
2011	No further response actions required.

Table 8-4	MCP Activities Status of Massport Sites at Logan Airport (Continued)
Location (Release Tracking Number) and MassDEP Reporting Status	**Action/Status**
6. Fire Training Facility (3-28199)	
2010	A RAM Plan was submitted to MassDEP on August 6, 2010. A RAM Status Report was submitted to MassDEP on December 3, 2010.
2011	A RAM Completion Statement was submitted on April 25, 2011.
	A Phase II Scope of Work was prepared and submitted to MassDEP on January 18, 2011. Phase II and Phase III Reports were submitted on December 8, 2011. A RAM Completion Statement was submitted on April 25, 2011.
2012	Phase 4 Status Report transmitted in June 2012; the Phase IV Remedy Implementation Plan was submitted in December 2012.
2013	Phase 4 Status Report transmitted in June 2013, the Phase IV Completion Report was transmitted in December 2013.
2014	Phase 5 Remedy Operation Status Reports submitted in June and December, 2014.
7. Southwest Service Area (3-28792)	
2010	A Class B-1 RAO was submitted to MassDEP on October 18, 2010. No further response actions required.
2011	No further response actions required.
8. Airfield Duct Bank Site (3-29716)	
2010	Release notification form was submitted on December 22, 2010.
2011	A Class A-1 RAO was submitted on December 23, 2011. No further response actions required.
9. West Outfall Release (3-29792) 2011	Release notification form was submitted on April 8, 2011. Two IRA Status Reports were submitted to MassDEP on June 9 and December 5, 2011. An RAO was submitted on February 13, 2012. No further response actions required.
10. Hertz Parking Lot Site (3-30260)	
2011	Release notification form was submitted on August 29, 2011 RAM Plan was submitted to MassDEP on September 1, 2011.
2012	A Class A-2 RAO was submitted on September 10, 2012. No further response actions required.
11. Former Butler Aviation Hangar (3-30654)	
2012	Verbal notification of a release was provided to the DEP on February 14, 2012, when RCC construction encountered an unidentified underground storage, and a Release Notification Form was submitted on April 23, 2012.
	An IRA Plan was submitted on May 21, and IRA Status Reports were submitted on June 18 and December 26, 2012.
2013	Phase I Report and Tier Classification submitted February 21, 2013 and IRA Completion Report submitted on July 11, 2013
2014	A Permanent Solution Statement was submitted in October 2014. No further response actions required.
	Release Notification Form submitted August 4, 2014.
12. Hangar 16 (3-32351)	Release Notification Form submitted August 4, 2014.

Source: Massport
Notes: This list includes Massport MCP sites only. Additional sites are the responsibility of Logan Airport tenants. Refer to Figure 8-2 for location of MCP sites.
Complete information dating back to 1997 is included in *Appendix J, Water Quality/Environmental Compliance Management*.

AUL	Activity and Use Limitation	Phase I	Initial Site Investigation
MCP	Massachusetts Contingency Plan	Phase II	Comprehensive Site Assessment
RAM	Release Abatement Measure	Phase III	Identification, Evaluation, and Selection of Comprehensive Remedial Actions
RAO	Response Action Outcome	Phase IV	Implementation of Selected Remediation Action
FDS	Fuel Distribution System	Phase V	Operation, Maintenance and/or Monitoring
IRA	Immediate Response Action		

Environmental Compliance and Management

Massport works to minimize environmental impacts at Logan Airport through ongoing programs and new initiatives. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles.

> *"Massachusetts Port Authority (Massport) is committed to operate all of its facilities in an environmentally sound and responsible manner. Massport will strive to minimize the impact of its operations on the environment through the continuous improvement of its environmental performance and the implementation of pollution prevention measures, both to the extent feasible and practicable in a manner that is consistent with Massport's overall mission and goals."*

Massport's overall environmental compliance and management efforts address the following goals:

- Protect water quality Airport-wide;
- Protect groundwater resources;
- Protect surface water resources (Boston Harbor);
- Minimize air quality impacts;
- Protect resources during construction;
- Mitigate construction impacts;
- Reduce occurrences of fuel leaks and spills; and
- Preserve coastal resources adjacent to the Airport.

The progress report for environmental compliance and management in Table 8-5 summarizes Massport's mechanisms for implementing these goals and details where changes to these efforts occurred in 2014.

Table 8-5 Progress Report for Environmental Compliance and Management

Plan Elements	Progress Report for 2014
Environmental Compliance Inspections	In 2014, Massport performed tenant inspections at a number of its National Pollutant Discharge Elimination System (NPDES) co-permittees' (Logan Airport tenants) leaseholds and made recommendations suggesting how to rectify issues identified during the inspections.
Environmental Management System (EMS) and International Organization for Standardization (ISO) 14001	ISO 14001 certification began for Facilities II (Vehicle maintenance, Landscaping, and Snow Removal) in December 2006. In 2010, Massport expanded the Logan Airport EMS to include Facilities I (Central Heating and Cooling Plant), Facilities II and Facilities III (Electrical and Structural). The most recent certification audit took place in June 2014, and a certificate was issued in July 2014; this certificate expires in July 2017.
Tenant Technical Assistance	Massport continued publication of *EnviroNews*, a quarterly newsletter that informs tenants of regulatory calendar milestones, permitting requirements, pollution prevention, and best management practices (BMPs). It recommends use of sustainable materials and provides information on Massport and other environmental requirements (2014 newsletters are provided in *Appendix J, Water Quality/Environmental Compliance and Management)*.
Stormwater Pollution Prevention Plan (SWPPP)	In accordance with the requirements of the current stormwater outfall NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and 25 other co-permittees were required to develop SWPPPs. Massport completed its SWPPP in December of 2007. An update to the SWPPP was completed in December 2014 and distributed to Massport and all stormwater co-permittees. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemicals, potential bacteria, fuel and oil, and other sources of stormwater pollutants. BMPs are included in the SWPPP. In accordance the other requirements of the NPDES permit, Massport is required to conduct training for personnel responsible for implementing activities identified in the SWPPP. The 2014 Annual Certificates of Compliance were submitted to EPA and MassDEP in December 2014 for Massport and each of its co-permittees.
Construction	Massport developed Sustainable Design Standards and Guidelines (SDSG) for use by architects, engineers, and planners who manage capital improvement projects for Massport (More information on SDSG is provided in *Chapter 1, Introduction/Executive Summary*). The SDSG, first issued in 2009 and revised in 2011, are designed to foster innovation yet include clear targets to achieve more sustainable project design and practices. The SDSG are intended to evolve over time, based on changes in technologies and industries. Massport provides a generic SWPPP to contractors for all Logan Airport construction projects, which provides guidance in preparing project-specific SWPPPs and BMPs to control sedimentation and other pollutants from construction projects. Massport monitors construction projects at Logan Airport for compliance with project SWPPPs and regulatory requirements. For all construction projects, Massport requires the use of ultra-low-sulfur diesel fuel in construction equipment, recycling of all construction waste to the maximum extent possible, and construction equipment retrofits with pollution control devices such as diesel oxidation catalysts and/or particulate filters.

Table 8-5 Progress Report for Environmental Compliance and Management (Continued)

Plan Elements	Progress Report for 2014
Spill Prevention Control and Countermeasure (SPCC) Plans	Tenants meeting certain thresholds are required to prepare their own SPCC plans for their facilities. Massport checks for SPCC plans during its environmental compliance inspections. Additionally, tenants receive information on Massport BMPs, which focus on spill management and prevention.
Air Emissions Reduction	All Massport diesel vehicles are now fueled with ultra-low-sulfur diesel. In 2007, Massport investigated the use of parking heaters, which operate independently of a vehicle's engine, to measure fuel savings/air emissions reductions of reduced vehicle idling during snow operations. The investigation was discontinued in 2008 after Massport found that the parking heaters resulted in draining vehicle batteries. Massport will continue to explore anti-idling technologies as part of the EMS.

Source: Massport

Logan Airport Sustainability Management Plan (SMP)

In 2013, Massport was awarded a grant by the FAA to prepare a Sustainability Management Plan (SMP) for Logan Airport. The Logan Airport SMP planning effort began in May 2013 and was completed in April 2015. The SMP takes a broad view of sustainability including economic vitality, social responsibility, operational efficiency, and natural resource conservation considerations. The Plan builds on Massport's rich history of advancing sustainability and serves as a roadmap for prioritizing initiatives and moving goals forward. The SMP is intended to guide Massport's sustainability practices over the next decade and supports the Authority's ongoing commitment to environmental stewardship.

The SMP represents the combined efforts of over 125 employees and tenants who came together to establish Massport's baseline sustainability performance, shape goals, and identify new sustainability initiatives. Massport is focused on a holistic approach with an emphasis on economic viability, operational efficiency, natural resource conservation, and social responsibility. As part of the SMP process, Massport developed a Sustainability Mission Statement:

"Massport will maintain its role as an innovative industry leader through continuous improvement in operational efficiency, facility design and construction, and environmental stewardship while engaging passengers, employees, and the community in a sustainable manner."

The SMP also included several groundbreaking elements including the launch of an Authority-wide sustainability engagement calendar and the development of Sustainability Planning Optimization Tools (SPOT™). The SMP Highlights Report and calendar can be viewed on Massport's website at the following address: http://massport.com/environment/sustainability-management-plan/.

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Project Mitigation Tracking

Introduction

This *2014 Environmental Data Report (EDR)* provides an update on the Massachusetts Port Authority's (Massport) mitigation commitments under the Massachusetts Environmental Policy Act (MEPA) for Logan Airport projects where an Environmental Impact Report (EIR) was filed. Each of the projects completed the state and federal environmental review processes and adopted a mitigation plan that has been formalized with individual Section 61 Findings.[1] Massport tracks both Massport and Logan Airport tenants' progress toward implementing and meeting their environmental mitigation commitments on schedule and according to the requirements set out in the Section 61 Findings for each project. As each project moves forward through its design and construction phases, its mitigation plan is implemented with ongoing tracking to ensure compliance. This chapter provides Section 61 mitigation commitment updates in 2014 for projects for which mitigation is ongoing or upcoming (Tables 9-1 through 9-7). Projects for which mitigation has been completed are not reported on in Environmental Data Reports (EDRs) and Environmental Status and Planning Reports (ESPRs). For projects with ongoing requirements, once those projects are constructed, mitigation tracking will report only on the continuing requirements.

Projects with Ongoing Mitigation

- **West Garage Project**, Executive Office of Environmental Affairs (EOEA, now Executive Office of Energy and Environmental Affairs (EEA)) #9790 (Phase I and Phase II construction is complete). The status of continuing requirements is documented.
- **International Gateway Project**, EEA #9791 (Phase I was completed in 2004; Phase II was completed in 2007; the final phase is not expected to be completed before 2015). The status of continuing requirements for Phases I and II are documented. As part of a separate project, Massport is considering extending the existing International Terminal E. The Terminal E Modernization Project would accommodate existing and long range forecasted passenger demand for international service and would include the three gates permitted and approved as part of the West Concourse Project in 1996, and up to two to four additional new aircraft contact gates. An Environmental Notification Form (ENF) for the Terminal E Modernization Project is forthcoming in the very near future (see *Chapter 3, Airport Planning* for additional information).

1 Massachusetts General Law, Chapter 30, Section 61 (M.G.L. c. 30, § 61).

- **Replacement Terminal A Project**, EEA #12096 (Terminal A opened March 16, 2005). The status of continuing mitigation requirements is documented.
- **Logan Airside Improvements Planning Project**, EEA #10458 (Runway 14-32 opened on November 23, 2006. The Centerfield Taxiway was completed and became fully operational in 2009). The status of continuing mitigation requirements is documented.
- **Southwest Service Area (SWSA) Redevelopment Program**, EEA #14137; on May 28, 2010, the Secretary of EEA issued a Certificate that determined that the Final EIR adequately and properly complied with MEPA and its implementing regulations. The Section 61 Findings for the SWSA Redevelopment Program were approved on June 17, 2010. Construction of the Rental Car Center (RCC) program began in summer of 2010, and the first phase of the facility opened in the fall of 2013. Other phases of the project were completed in 2014. The status of ongoing mitigation requirements is documented.
- **Logan Airport Runway Safety Areas (RSA) Project**, EEA #14442; on March 18, 2011, the Secretary of EEA issued a Certificate that determined that the Final Environmental Assessment (EA)/EIR adequately and properly complied with MEPA and its implementing regulations. Construction on the Runway 33L RSA began in June 2011 and was completed in November 2012. The replacement of the Runway 33L approach light pier was completed concurrently with Runway 33L RSA construction. Construction of the Runway 22R Inclined Safety Area (ISA) was completed in fall 2014. The status of the Runway 33L RSA enhancement project ongoing mitigation requirements is documented.

Projects with Section 61 Mitigation

The following section documents the status of projects with Section 61 mitigation commitments, in chronological order starting with the West Garage Project from 1995 to the Runway Safety Area Improvement Project which recently completed its final phase. Massport will continue to report on the status of mitigation in EDRs and ESPRs to provide a solid accounting of Massport's commitment to regulatory compliance and to provide information to the community.

West Garage Project – EOEA #9790

Permitting History

- Certificate on the Final EIR issued on March 16, 1995
- Section 61 Findings approved on March 27, 1995

Project Status

The West Garage Project (Figure 9-1) was initially proposed to be constructed in two phases. Phase I of the Project provided 3,150 parking spaces that were consolidated from other areas of Logan Airport. The West Garage is directly connected to the Central Garage, centralizing the two structures' parking into a larger, single functioning, easily accessible garage. The West Garage Project also included construction of elevated walkways connecting the West Garage to Terminals A and E, and improvements to the terminal roadways. The original design of Phase II of the West Garage included the construction of a new structured parking facility adjacent to the West Garage. Instead, Massport concluded it was more cost efficient to proceed with Phase II by adding three additional levels (Levels 5, 6, and 7) to the existing Central Garage. Phase II of the West Garage Project provided approximately 2,800 additional parking spaces.

- Phase I – Construction commenced in October 1995 and the garage opened on September 8, 1998. The elevated walkways to the terminals were completed in 2002. Improvements to terminal roadways were completed in 2003.
- Phase II – Permitting completed in 2000 to add three levels to the Central Garage. Construction commenced in 2004 and the entire facility enhancement was completed in 2007.

Table 9-1 lists each of the continuing Section 61 mitigation commitment for the West Garage Project and Massport's progress in achieving these measures. Table 9-2 details the elements and status of the Alternative Fuels Program, which was a key mitigation effort associated with the West Garage Project. The mitigation measures in Tables 9-1 and 9-2 are from Section 61 Mitigation of the *West Garage Project Final EIR*, January 31, 1995, and those measures referenced in the Massport Board vote on the West Garage Project. Many of the mitigation measures for this project have long since been implemented but it is noted in the tables when there have been recent updates.

Unrelated to this project, Massport is consolidating 2,050 temporary parking spaces as part of an addition to the West Garage and at the existing surface lot between the Logan Office Center and the Harborside Hyatt. These spaces constitute all remaining spaces under the Logan Airport Parking Freeze. On March 20, 2014, the EEA issued an Advisory Opinion confirming that no MEPA review was required for this consolidation of existing on-Airport parking spaces. Construction is expected to be completed in late 2015.

Figure 9-1 West Garage Project

Phase I West Garage Construction
Phase II Addition to Central Garage

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014)**

Mitigation Measure	Status
Parking Pricing	
Parking pricing initiatives: keeping first-hour price high enough to provide a disincentive for pick-up/ drop-off.	**Implemented.** Massport continues to evaluate and adjust the first-hour price of parking. In light of the security prohibition on curbside parking, in 2002, Massport reduced the cost of the first half-hour from $4 to $2, the first time it had changed since the first-hour free rate was rescinded in 1998. In June 2007, rates increased to $3 for the first half-hour. Parking rates increased in March 2012 for on-Airport parking; further details on parking rate increases are provided in Table 5-6 of *Chapter 5, Ground Access to and from Logan Airport.*
Parking pricing initiatives: keeping the weekly price low enough to encourage vacation travelers to park for a week.	**Implemented.** Massport encourages long-term parking by providing lower cost parking at its Economy Lot. Data on long-term parking use are provided in *Chapter 5, Ground Access to and from Logan Airport.*
Massport will consider means to encourage the use of limited amount of on-Airport commercial parking for long-term parking and promote environmentally positive modes of airport access by air passengers.	**Implemented.** An important element of Massport's strategy to reduce the impact of Airport-related traffic on regional highways and local streets in neighboring communities is the Massport Parking Pricing Policy. Historically, Massport's Parking Pricing Policy encouraged long-term parking over short-term parking. That was accomplished by charging a premium for time spent in the on-Airport parking facilities between one and four hours and substantially reducing the per hour rate for parking durations longer than four hours. This strategy has proved to be a successful incentive for passengers to drive themselves and park long-term at Logan Airport rather than having someone else drop them off or pick them up. Additional information on parking is provided in *Chapter 5, Ground Access to and from Logan Airport*.
Once sufficient data have been collected, Massport will evaluate parking behavior that may be attributable to the modified rates and consider further adjustments in pricing that will assist in achieving Massport's ground transportation goals.	**Implemented.** Massport's parking rate structure is compatible with continued growth in long-term parking, and the continued goal to increase the total high occupancy vehicle (HOV) use by air passengers toward 35.2 percent HOV access mode share. Adjustments to hourly parking rates have been made over time to reflect usage patterns. Additional information on parking pricing is provided in *Chapter 5, Ground Access to and from Logan Airport*.
Executive Director shall report to Massport annually regarding the effectiveness of parking pricing policy in achieving Massport's ground access goals initiatives and recommend appropriate policy adjustments.	**Implemented.** In October 2001, the Massport Board granted approval of commercial parking rates consistent with Massport's ground access goals. The higher rates went into effect November 12, 2001. In addition, in light of the new security restrictions on curbside parking, Massport reduced the cost of parking for the first half-hour from $4 to $2. In June, 2007, the cost of parking for the first half-hour increased to $3. These modifications foster the use of alternate forms of transportation for getting to Logan Airport, whereas the weekly cap at Economy Parking encourages long-term parking over pick-up and drop-off as a mode of access. Please refer to *Chapter 5, Ground Access to and from Logan Airport*, for additional details on Massport's parking pricing efforts.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)**

Mitigation Measure	Status
Concurrent Ground Access Improvement Mitigation Measures	
Employee Trip Reduction Measures	
Massport will form a Transportation Management Association (Logan TMA) for Logan Airport employees to provide new opportunities for the development of targeted transportation demand management (TDM) strategies for Massport and airport tenant employees.	**Implemented.** In the 1995 Board Resolution, Massport's Executive Director was authorized to expend an initial amount of up to $50,000 for the purpose of organizing the Logan TMA. The Logan TMA was created in March 1997. Massport continues to support the Logan TDM strategies by funding the Logan Sunrise Shuttle at an annual cost of $65,000.
Massport will seek to develop, coordinate, and implement effective TDM strategies to reduce the number of single-occupant trips made by all Logan Airport employees.	**Implemented.** Massport continues to work with the MassDOT to support the Logan TMA. The 1995 Board Resolution authorized Massport to actively explore with the Logan TMA the feasibility of implementing various services. Massport assists the Logan TMA in providing services and by periodically conducting the Logan Airport Employee Survey (a survey was conducted in 2010). Results of the 2010 survey are summarized in *Chapter 5, Ground Access to and from Logan Airport.* The next survey is planned for 2016.
Massport will encourage participation by all employees, but will particularly target the airport's largest employers.	**Implemented.** Massport continues to target Logan Airport's largest employers. Refer to *Chapter 5, Ground Access to and from Logan Airport* for more details on the Logan TMA.
Massport will report on the formation and activities of the Logan TMA in the next Generic Environmental Impact Report (GEIR).	**Implemented.** The Environmental Status and Planning Reports (ESPRs) and Environmental Data Reports (EDRs) provide information on the Logan TMA. on the current status of the Logan TMA is summarized in *Chapter 5, Ground Access to and from Logan Airport*.
Massport proposes to implement a new Logan Express service or other HOV service depending on the needs of the targeted market before Phase II of the West Garage Project is operational.	**Implemented.** The Peabody Logan Express facility opened in September 2001 (See *Chapter 5, Ground Access to and from Logan Airport* for additional information on Peabody Logan Express). Despite low ridership, Massport continues to operate this service. In 2014, Massport initiated the Back Bay Logan Express service, which provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square Station, and Logan Airport.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)**

Mitigation Measure	Status
Provide an airport shuttle service from South Station Transportation Center. Massport is preparing a feasibility and business plan for a South Station-Logan Airport shuttle service and will implement this service when the Third Harbor Tunnel is opened for commercial traffic. This service will be modeled on the existing, successful Logan Express services and will include frequent bus service between South Station and the airport terminals.	**Implemented.** In 1997, Massport sponsored the development of a joint public/private partnership with intercity bus operators serving the South Station Transportation Center. This partnership resulted in a bus connection that both the carriers and Massport. The service had limited success largely because of variable operator schedules and the fact that the service operates out of the South Station Transportation Center instead of a location closer to the South Station Red Line stop. Following the interim Logan DART service between Logan Airport and South Station in 2000, in June 2005, Massport and the Massachusetts Bay Transportation Authority (MBTA) jointly commenced full Silver Line Airport Service providing a direct connection between South Station and each Logan Airport terminal. Refer to *Chapter 5, Ground Access to and from Logan Airport* for additional information on the Silver Line.
Massport will regularly evaluate the frequency of, and demand for, such shuttle service and will provide such service at the greatest frequency that is practical and effective.	**Implemented.** Massport continues regular collaboration with MBTA on the Silver Line Airport Service and makes adjustments as necessary. Since May 2012, Massport has sponsored a pilot program offering free rides on the Silver Line from Logan Airport to downtown Boston to promote HOV usage and heighten awareness of public transit options. The purpose of the pilot program is to promote ridership, operations, and customer service. Free service will continue as of the date of this *2014 EDR*.
Massport will implement a new water shuttle service in Boston Harbor before the opening of Phase I of the West Garage Project. The water shuttle would run between Logan Airport and one, or possibly, more sites in the Harbor.	**Implemented.** Massport identified a number of possible destinations for a new water shuttle service, with the Quincy Shipyard and Long Wharf sites meeting the basic service parameters. Harbor Express was chosen as the water shuttle operator and began operation between the Airport and these two sites in November 1996. Massport continues to support the Rowes Wharf Water Taxi and City Water Taxi operations. Refer to *Chapter 5, Ground Access to and from Logan Airport* for water shuttle ridership information.
The Executive Director shall make recommendations to Massport for budgetary appropriations to establish and implement the new ground access services on a schedule that permits Massport to implement the new ground access services within these time frames.	**Implemented.** The Executive Director/CEO recommends budgetary appropriations for ground access services on an annual basis.
Enhancement of Existing HOV Services: Logan Express	
Expand Logan Express hours of service.	**Implemented.** Service is offered from Braintree as early as 3:00 AM and as late as 11:00 PM; from Framingham as early as 3:15 AM and as late as 11:00 PM; from Woburn as early as 3:00 AM and as late as 11:00 PM; and from Peabody as early as 3:15 AM and as late as 10:45 PM. Buses leave every hour or half hour. Logan Express buses now depart from Logan Airport as late at 1:15 AM. The Logan Express schedule is available at https://www.massport.com/logan-airport/to-and-from-logan/logan-express/.
Provide a guaranteed ride home for Logan Express users.	**Implemented and subsequently modified.** From January 1995 until November 2001, Massport provided this service for air passengers and Logan TMA members. Due to financial constraints following September 11, 2001, this program was suspended for those passengers arriving after midnight with pre-purchased round-trip Logan Express tickets.

Table 9-1 West Garage Project Status Report (EOEA #9790) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)

Mitigation Measure	Status
Provide Logan Express price incentives.	**Implemented.** Massport continues to monitor price incentives and implements additional incentives to promote Logan Express ridership, particularly during vacation periods and other periods of peak airport activity. In April 2011, Logan Express sites offered a discounted rate for parking. A survey of Logan Express passengers revealed that drop off activity at Logan Airport was reduced and the demand for parking at Logan Airport was reduced during the period of the discounted Logan Express parking. To encourage greater ridership, Massport restructured parking rates, which lowered parking rates to $7 per day from $11 per day at Logan Express parking lots. These rates went into effect on March 1, 2012 and are still in effect today (and resulted in increased Logan Express passenger activity at rates greater than the increase in Logan Airport air passengers). Additional seasonal and holiday promotions are also offered.
Develop an additional Logan Express service.	**Implemented.** Massport opened a fourth Logan Express in Peabody, Massachusetts in September 2001, several years before the Section 61 Commitment date of the opening of Phase II of the West Garage Project. While the new service was initially planned to operate on a half-hour schedule like the Braintree, Framingham, and Woburn services, because of the dramatic air passenger reductions after September 11, 2001, (during Peabody's first week of service), to cut costs, Massport operated the Peabody Logan Express on hourly headways. In January 2004, in light of low levels of ridership on the Peabody Logan Express, Massport doubled service by going to a half-hourly schedule in an effort to stimulate ridership growth at Peabody. The service now operates on an hourly weekday schedule. In 2014, Massport initiated the Back Bay Logan Express service, which provides travelers with three scheduled trips per hour between the Hynes Convention Center, Copley Square Station, and Logan Airport.
Enhancement of Existing HOV Services: Water Transportation	
In conjunction with the MBTA, Massport will pursue joint ticketing opportunities for the Hingham Commuter Boat and the Logan Airport Water Shuttle.	**Implemented.** This ticketing program was explored, implemented in mid-1995 and discontinued in 2000 since many of the former users of this program now use the Harbor Express Service direct from Quincy to Logan Airport.
Massport is reviewing the fee schedules and operating requirements of the dock to make it more accessible and convenient to potential water taxi operators.	**Implemented.** In the fall of 1995, Massport made physical improvements to a low-freeboard float at the Logan Dock to create a dock capable of accommodating smaller vessels such as water taxis. In the fall of 2002, Massport completed expansion of the Harborside dock to accommodate the demand of additional vessels and to comply with handicapped accessibility requirements. The improved dock increases capacity from a two float system to a seven float system to accommodate the various water shuttles, taxis, and charter boats that are licensed to use it.
Initiate a new Boston Harbor Water shuttle service.	**Implemented.** Harbor Express service, between Logan Airport and the South Shore, began in November 1996, well before the opening of Phase I of the West Garage in September 1998. In 2001, the MBTA took over operations of this service.
Expand docking capacity at Logan Airport for water taxi and other services.	**Implemented.** Massport accommodates water taxi services, enhanced the dock as described above, provides communication links for passengers to call the taxi, and allows taxi passengers to use the free water shuttle buses to access the terminals from the dock. Water taxi information is posted on the Massport website. Details on the Water Taxi are provided in *Chapter 5, Ground Access to and from Logan Airport*.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)**

Mitigation Measure	Status
Other Measures	
Coordinate with public and private entities to provide more extensive radio, television, and telephone announcements of poor traffic conditions with suggestions for alternative access modes.	**Implemented.** The 1-800-23LOGAN Customer Information Line includes the number of the telephone text information line. Callers to Customer Information Line may access the latest traffic information, flight status, parking information, cell phone waiting lot information, or learn about alternative forms of transportation to and from Logan Airport. Starting in August 1999, real-time traffic information and parking became accessible on Massport's website. Massport regularly contacts the media to inform the public about roadway changes, parking shortages and to encourage travelers to use HOV services. Similar information is disseminated on the Logan Airport e-mail subscriber list, the Massport website, Facebook, and on Twitter at twitter.com/bostonlogan.
HOV Marketing and advertising. Massport will continue the advertising and marketing programs for HOV services with an emphasis on promoting MBTA, Logan Express and water shuttle services to and from the airport.	**Implemented.** Massport continues to marketing Logan Express services via Massport's website and other media. Massport continues to promote HOV services including availability, schedules and fares to consumers through the ground transportation Information Line at 1-800-23LOGAN and the website that provides up to the minute information. HOV advertising boards, schedules, and maps are placed at all Logan Airport terminals, at the MBTA Airport Station and at all shuttle bus pick-up/drop-off locations. Massport has actively promoted passenger water transportation in Boston Harbor for more than 20 years, playing a leadership role in policy development, planning, and promotions. This has included promoting vessel services at Logan Airport in the following ways: ▪ Annual updates and in-terminal and citywide distribution of a brochure promoting water transportation at Logan Airport; ▪ Annual updates of harbor-wide water transportation map showing routes serving Logan Airport and other routes and landings as well – Massport provides this map to the MBTA, area non-profits, and others interested in promoting passenger water transportation in Boston Harbor; ▪ Updated information promoting passenger water transportation at Logan Airport on 1-800-23-Logan and www.massport.com; and ▪ Collecting, tracking, and disseminating passenger water transportation ridership data for Logan Airport passengers to aid in planning and facility development.

Table 9-1 West Garage Project Status Report (EOEA #9790) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)	
Mitigation Measure	**Status**
Prepare an inventory of private scheduled services including origins/destinations, schedule, and cost.	**Implemented.** Massport continues to update and track information and services by more than 700 privately operated passenger services certified to operate at Logan Airport. Industry changes with such operations make publication of reliable service and schedule information impractical, if not impossible. However, Massport continued to expand and update information on transportation options to Logan Airport using the latest information technologies, including: ▪ Information and links to transportation companies on the Massport website. Some sites accessed through internet links provided passengers with on-line reservation services; ▪ Most scheduled service operators provided placards with current schedules posted in bus stop shelters located on the curb at each terminal. Individual bus schedules were also available at the information booths; and ▪ Transportation information database for on-line assistance at Logan Airport terminal information booths.
Proceed with environmental review and seek funding for construction of People Mover system.	**Implemented.** Massport completed the Environmental Assessment (EA) and Major Investment Study for the Logan Airport Inter-modal Transit Connector (AITC). The AITC evolved out of the People Mover process and evaluated new access routes to both the Blue Line and the South Station Transportation Center. On February 25, 1997, Massport submitted to the U.S. House Committee on Transportation and Infrastructure an application for the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) funds for the next phase of environmental review, planning and design of the AITC. Congressman J. Joseph Moakley was the congressional sponsor; the project also has the support from the Secretary of Transportation and the U.S. Environmental Protection Agency (EPA). The Logan AITC was included, for an unspecified funding level, in the 1997 ISTEA reauthorization bill. In 1998, Massport received a certificate on a Notice of Project Change (NPC) for the People Mover from the Secretary of EEA and a Finding of No Significant Impact (FONSI) on an EA from the Federal Transit Authority. In June 2001, Massport and the MBTA executed an interagency agreement for the purchase of eight Silver Line dual mode buses and the Massport Board approved the expenditure of approximately $13 million for this purchase. In 2004, Massport and the MBTA finalized the 10-year/$20 million dollar Inter-Agency Operating & Maintenance Agreement. Initial Silver Line service to the Airport began in December 2004 and full service began in June 2005 (refer to *Chapter 5, Ground Access to and from Logan Airport* for additional details).
Alternative Fuels program. Massport is carrying out an extensive program to convert existing Massport-owned service vehicles to environmentally preferable sources.	**Implemented.** Table 9-2 of this *2014 EDR* details Massport's progress in achieving these measures.

**Table 9-1 West Garage Project Status Report (EOEA #9790)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)**

Mitigation Measure	Status
Measuring, Monitoring, and Evaluating Ground Access Improvements	
Massport will assess progress towards the achievement of HOV goals using on-Airport Automated Traffic Monitoring Systems (ATMS).	**Implemented.** Massport has an ATMS plan that provides daily traffic counts at all gateways and other critical locations. Massport uses technologies that utilize on-Airport traffic signal controllers and loops for traffic counting. The Logan ATMS uses technologies that detect vehicle movement: inductive loop lines, and microwave sensors. Upgrades of the ATMS equipment, program software and infrastructure are underway and will result in accurate, meaningful vehicle counts. With the completion of the Terminal Area Roadway system and other regional highways expected in the near future, The project is complete and the upgraded ATMS is functioning as planned and designed.
Massport will assess progress towards the achievement of HOV goals by monitoring parked vehicles using systems such as the parking and revenue control (PARC) system.	**Implemented.** Massport monitors all parking activity at Logan Airport and inventories all commercial parking facilities on a daily basis. Updated PARC systems were installed in the Terminal B Garage in 2004, with Central/West Garage following in 2005. Terminal E parking areas and the Economy Garage also have PARC systems.
Monitor HOV Services (Logan Express, MBTA, water shuttle, limousine/bus, and taxi).	**Implemented.** Massport maintains a "real time" log of dispatcher reports for Logan Express, the taxi pool, and the bus/limousine pool and other ground transportation operations at Logan Airport. Massport coordinates with the MBTA and the operators of all water shuttles serving Logan Airport to track ridership and service schedules. Daily Logan Express ridership and operations data are submitted monthly to Massport. Massport maintains a Passenger Water Transportation Ridership Summary on a monthly basis. Massport maintains a continuing record, the Ground Transportation Unit (GTU) Daily Event Log, of all occurrences impacting the Airport roadways, terminal curbs, and access roads. This log cites such events as accidents, lane closures, bus delays, as well as routine and non-transportation events.
Monitor passenger activity and employee modes of transportation.	**Implemented.** The most recent air passenger survey was conducted in the spring of 2013 and is summarized in *Chapter 5, Ground Access to and from Logan Airport.* The next survey is scheduled for spring 2016.
Massport supports the use of Automated Vehicle Identification (AVI) to monitor, manage, and facilitate efficient traffic operations at Logan Airport and elsewhere on the regional transportation system.	**Implemented.** An AVI system for Massport's Logan Airport shuttles and Logan Express buses was implemented. All new buses are being procured with AVI/global positioning system (GPS), in anticipation of a planned "next bus" arrival notification system. In addition, the new Rental Car Center (RCC) has an operations room with the required equipment to track the new clean-fuel unified bus fleet.
Track the effectiveness of ground access measures.	**Implemented.** Massport continues to track the effectiveness of its ground access mitigation programs in its annual MEPA filings. See *Chapter 5, Ground Access to and from Logan Airport* for 2014 details.

Source: Massport
Note: Text in italics detailing the mitigation measures is from Section IV, Mitigation of the West Garage Final EIR, January 31, 1995.

Table 9-2 describes the Alternative Fuels Program, which was part of the West Garage Section 61 commitments.

Table 9-2 Alternative Fuels Program — Details of Ongoing Section 61 Mitigation Measures for the West Garage Project (as of December 31, 2014)

Program Element	Projected Date of Completion/ Acquisition	Status
Purchase four electric passenger utility vehicles	Winter 1995	**Implemented.**
Purchase five electric sedans	Winter and Summer 1995	**Implemented.**
Build compressed natural gas (CNG) quick-fill station	Spring 1995	**Implemented.** The CNG station has been operational since 1995. It is one of New England's largest retail CNG quick fill stations and serves approximately 30 of Massport's CNG vehicles (18 of which are the Massport-owned 42' CNG buses) along with a dozen Airport tenants including nearby hotel CNG shuttle bus fleets. In calendar year 2014, the station pumped approximately 32,983 gallon equivalents per month. Sixty-five percent of the fuel is purchased by Massport and 35 percent by outside vendors.
Purchase five electric buses	Spring and Summer 1995	**Implemented.** Massport purchased two electric buses and leased one. These vehicles operated at Logan Airport between 1996 and 2001. After more than six years of testing and evaluation, Massport determined that electric buses are neither durable nor dependable enough to function effectively in the demanding operating environment at Logan Airport. Massport's new unified bus fleet includes clean diesel/electric hybrid buses. Massport will continue to evaluate electric and other alternative fuel vehicles (AFV) as new technologies become available.
Purchase five electric pick-up trucks	Spring 1995	**Implemented.**
Use soy-blend diesel fuel	Spring 1995	**Implemented.** Massport's shuttle fleet operated on soy diesel from 1995 to 1999. In 1999, all the buses were replaced with CNG buses. This fleet was fully replaced in 2012 by CNG and clean-diesel/electric hybrid buses.
Purchase additional AFVs	Spring 1995	**Implemented.** Refer to *Chapter 7, Air Quality/ Emission Reductions* for a list of AFVs.
Purchase six CNG buses	Summer 1995	**Implemented.** The initial fleet of 26 CNG shuttle buses was fully replaced in 2012 with 32 60-foot clean diesel/electric hybrid buses and 18 42-foot CNG buses.
Purchase four electric vans	Summer 1995	**Implemented.**
Install quick-charge kiosks for electric vehicles	Summer 1995	**Implemented.**
Develop slow-charge infrastructure	Ongoing	**Implemented.** The electric charging infrastructure included 15 inductive charging locations but these are not in use since there are no vehicles currently using inductive charging. In 2012, Massport installed 13 new electric vehicle (EV) charging stations to accommodate a total of 26 vehicles in the Central and Terminal B parking areas. The new Framingham Logan Express Garage also has two EV charging stations.

Source: Massport

International Gateway Project (Terminal E) – EOEA #9791

Permitting History:

- Certificate on the Final EIR issued on December 2, 1996
- Section 61 Findings submitted to EEA June 26, 1997

Project Status

The International Gateway Project (Figure 9-2) expanded and upgraded Terminal E to provide better service to international passengers. The original Terminal E was opened in 1974 and over time became outdated and too small to accommodate the growth in international travel. This project is being constructed in phases:

- **Phase 1 – Complete.** This phase of the project included a weather-protected outside airside bus portico with an elevator and escalator linking the ground floor with the second floor to accommodate passengers arriving on remotely parked aircraft that are unable to park at a gate because it is occupied by another aircraft.
- **Phase 2 – Complete.** This phase of the project enlarged Logan Airport's congested Federal Inspection Services (FIS) Facility, and improved the meeter/greeter lobby and the ticketing area of Terminal E to maximize passenger convenience and reduce processing times in the terminal. The project called for the reconstruction and expansion of Terminal E in and around the existing terminal while keeping it operational and safe. The new departure hall includes high ceilings, wood paneling, built-in artwork, and views of the city skyline. Additionally, to reduce curb and roadway congestion at Terminal E, this project also included a new separated roadway system for arrivals and departures.
- **Future Phase – Pending.** The West Concourse element of the International Gateway Project and its three additional gates were approved but never constructed. Planning for future terminal improvements is underway as part of the ongoing strategic planning effort and the Terminal E Modernization Project.

Construction of this project commenced in the summer of 1998. Phase 1 was completed in 2004. The departure level of the terminal, including the new ticketing hall and departure level roadway, opened in May 2003. Enlargement of the FIS Facility and construction of the new arrivals level was completed in July 2007. Phase 2 is now complete. Preliminary work was completed for the West Concourse including planning for three additional contact gates that were never built. Additional information on the status of this project is available in *Chapter 3, Airport Planning.*

As part of a separate new project, Massport is planning further modernization of the existing International Terminal E. The Terminal E Modernization Project would accommodate existing and long range passenger forecasted demand for international service and would include the three permitted but not built gates from the West Concourse project, and up to two to four additional new aircraft contact gates. An ENF is expected to be filed in the very near future (see *Chapter 3, Airport Planning* for additional information).

Table 9-3 lists each of the continuing mitigation measures for the International Gateway Project in the Section 61 Findings along with Massport's progress in achieving these measures through the end of 2014. Many of the mitigation measures for this project have long since been implemented but it is noted in the tables when there have been recent updates. Completed design and construction phase measures are described in previous EDRs.

Figure 9-2 International Gateway Project

Note: Runway 14-32 construction completed in November, 2006.

Table 9-3 International Gateway Project Status Report (EOEA #9791) Section 61 Mitigation Measures (as of December 31, 2014)

Mitigation Measure	Status
Alternative Fuel Outreach Program	
Massport is working cooperatively with the Environmental Protection Agency (EPA) and regional utility providers in coordinating an ongoing outreach program aimed at promoting the use of clean-burning alternative fuels. This program, which is also supported by fuel providers, vendors, and state and federal agencies, will offer information to airport tenants in the following areas: ▪ *Notification of grant programs or other financial incentives for vehicle conversions.* ▪ *Assistance in cost-benefit analysis for conversion of conventionally fueled vehicles to AFVs.* ▪ *Assistance in placing airport tenants in contact with alternative fuel suppliers and product vendors.*	**Implemented.** Massport continues to work cooperatively with Eversource, Alternative Vehicle Service Group (AVSG), the City of Boston, and the Massachusetts Clean Cities Coalition to promote the implementation and integration of Alternative Fuel Vehicles (AFVs) into local private and public fleets. In May 2007, Massport adopted two new policies to promote alternative fuel and hybrid vehicle usage at Logan Airport by others: 1) limited front-of-line taxi pool privileges; and 2) preferred Parking locations in the Central Garage and the new Economy Garage. These policies remain in effect.
High Occupancy Vehicle (HOV) Promotion	
Massport will reserve terminal space for ground transportation ticket sales, reservations, and information.	**Implemented.** This space has been provided in a staffed information area in the arrivals area of the new terminal. In a joint venture with Massachusetts Bay Transportation Authority (MBTA) Charlie Card automated fare collection equipment was installed in all Logan Airport terminals in 2006. In mid-2012, in an effort to encourage greater transit ridership, Massport commenced a pilot program for free boarding of the Silver Line at Logan Airport. Free Silver Line boarding continued throughout 2013 and 2014.
Attractive and distinctive signage and graphics will be utilized inside the terminal and out at the curb to clearly mark access to Logan Express, MBTA, water transportation, and other HOV options.	**Implemented.** Signage has been installed in the terminal and at the curbside identifying HOV curb locations. In 2012, Massport installed new digital signage at all terminal Silver Line curb locations to indicate next bus wait times which has improved passenger convenience.
As HOV services continue to develop and expand at Terminal E, Massport will expand its web page to encompass these new services and initiatives.	**Implemented.** Massport continues to reflect service changes on its website.
Massport and the MBTA will offer, on a trial basis, the sale of MBTA tokens via a vending machine in the baggage claim area of Terminal C.	**Implemented.** The MBTA Charlie Card machines are located at the MBTA's Blue Line Airport Station and in each of the Logan Airport passenger terminals. Massport continues to offer free service to Airport Station and the water shuttle dock with its fleet of CNG and clean diesel/electric hybrid buses. Since the summer of 2012, Massport has also sponsored a pilot program offering free rides on the Silver Line from Logan Airport to downtown Boston.

Note: Text in italics detailing the mitigation measures is excerpted from the Section 61 Findings submitted to the EEA, June 26, 1997.

Replacement Terminal A Project – EOEA #12096

Permitting History

- Certificate on the Final EIR issued on November 16, 2000
- Section 61 Findings submitted to EEA on August 31, 2001

Project Status

The Replacement Terminal A Project (Figure 9-3) involved the complete demolition of the pre-existing Terminal A and construction of a new facility by Delta Air Lines, consisting of a main terminal linked to a satellite concourse. The old Terminal A was closed in May 2002 and demolition commenced shortly thereafter. The project was designed to be constructed in five phases. However, as a result of September 11, 2001, air traffic at Logan Airport reduced dramatically allowing Massport to relocate the airlines at Terminal A to other terminals with minimal impact, and to shut down Terminal A entirely rather than having to phase construction concurrent with passenger activity. As a result, construction progressed ahead of schedule in 2003 and 2004. Terminal A opened on March 16, 2005.

In the spring of 2006, Delta Air Lines and Massport submitted an application for certification of Terminal A under the U.S. Green Building Council Leadership in Energy and Environmental Design® (LEED) Green Building Rating System™. LEED certification was awarded in June 2006, making Terminal A the first airport terminal in the world to be awarded LEED certification.

The following sustainable elements were incorporated into the design of Terminal A:

- Water conservation — low-flow toilets, and drip rather than spray irrigation.
- Atmosphere protection — zero use of chlorofluorocarbon (CFC)-based, hydrochlorofluorocarbon (HCFC) based, or halon refrigerants.
- Energy conservation — special roofing and paving materials that reflect solar radiation. Solar panels were installed on the roof of Terminal A in 2012.
- Materials and resources conservation — more than 10 percent of all the building materials used to construct the terminal were from recycled materials.
- Enhanced indoor environmental air quality — low and volatile organic compound (VOC) free adhesives, sealants, paints, and carpets were used.
- Sustainable sites — bicycle racks were installed in proximity to bus and subway systems.

Figure 9-3 Replacement Terminal A Project

Table 9-4 lists each mitigation measure in the Section 61 Findings along with Massport's progress in achieving these measures through the end of 2014.

Table 9-4 Replacement Terminal A Project Status Report (EOEA #12096) Section 61 Mitigation Measures (as of December 31, 2014)

Mitigation Measure	Status
Project Design Mitigation	
Logan Transportation Management Association (TMA) Participation	
Delta Air Lines, Inc. has joined Massport's Logan TMA. Delta Air Lines will designate an Employee Transportation Advisor at Terminal A to be the conduit between the Logan TMA Coordinator and Delta Air Lines employees.	**Implemented.** Delta Air Lines joined the Logan TMA and designated an Employee Transportation Advisor.
Additionally, Delta Air Lines will provide the following services as part of their Transportation Demand Management Program through the Logan TMA Transportation subsidy for full-time Delta Air Lines employees at Logan Airport; ride matching/carpooling; vanpooling; guaranteed ride home; preferential parking for HOVs; shuttle to and from employee parking.	**Implemented.** Transportation Demand Management (TDM) services are provided through Delta Air Lines and the Logan TMA.
Recycling Program	
The Replacement Terminal A will be included in within Massport's terminal recycling program.	**Implemented.** Paper, plastic, aluminum, glass, and cardboard are recycled at Terminal A.
High Occupancy Vehicle (HOV) Promotion	
HOV access can be accommodated on the departures level and will be designated near main entrances to the terminal building to ensure efficient and convenient unloading by air passengers who use these mode-types to access the Airport. *The inner-most curb of [the arrivals level] will be designated exclusively for HOVs and taxis, similar to the departures level.*	**Implemented.** Curbside HOV lanes give HOV modes preferential access to Terminal A for passenger convenience at both the arrival and departure levels. Coinciding with the opening of the Rental Car Center (RCC) (and its new on-Airport shuttle bus operations), in September of 2013, Massport made improvements to the terminal curbsides to increase access for HOV/transit/shared-ride modes. The improvements followed several general principles: situate HOV modes to the curb closest to the terminal and locate the airport's Blue Line/RCC shuttle stop adjacent to the Silver Line stop. Terminals B, C, and E underwent the most significant changes; in fact, the ground level of the Terminal B garage was converted to a taxi and limo pick-up area, eliminating all commercial parking from that level, and allowing extra curb space to be better allocated among the remaining HOV and other modes. Terminal A, which already had the primary HOV modes pick-up at the terminal curb (and private vehicles pick-up at the second/outer curb), underwent the fewest changes (notably relocating the Silver Line bus stop to be adjacent to the Blue Line/RCC shuttle stop). The curb improvements also included adding electronic "next bus arrival time" displays for the Massport shuttles and the Logan Express buses.

Table 9-4 Replacement Terminal A Project Status Report (EOEA #12096) Section 61 Mitigation Measures (as of December 31, 2014) (Continued)

Mitigation Measure	Status
Ground Service Equipment (GSE) Conversion *In conjunction with the Project, Delta Air Lines will implement a program for conversion of its entire GSE fleet at Terminal A as soon as viable alternative fueled fleet vehicles become available and can be effectively integrated into Delta Air Lines' operations at Terminal A. Delta Air Lines will introduce battery powered baggage tugs and belt loaders with the replacement terminal and convert this portion of the GSE fleet by the end of 2008. This represents over 40 percent of Delta Air Lines' current GSE fleet.*	**Implemented.** Terminal A incorporates infrastructure for GSE charging. In September 2009, Massport approved a $3 million dollar loan to Delta Air Lines for the purchase of battery-powered baggage tugs and battery powered-baggage conveyor belt vehicles. Delta Air Lines purchased 50 electric baggage cart tugs, 25 electric baggage conveyor belt vehicles, and charging stations for each vehicle. Thirty-two GSE charger installations have been completed, and are currently serving electric GSE.
Delta Air Lines will also examine the feasibility of locating a Compressed Natural Gas (CNG) fill station at Terminal A. The availability of a CNG fueling station would facilitate conventionally-fueled vehicles to be replaced with CNG-fueled vehicles where this vehicle option is offered. Delta Air Lines will introduce these vehicles into its GSE fleet as soon as they become available and are determined to be feasible and practicable for use at Terminal A.	**Implemented.** Delta Air Lines examined the feasibility of locating the CNG fill station at Terminal A and determined it to be infeasible given that the GSE conversions are trending toward electric vehicles and electric vehicle infrastructure meets demand. A public access CNG fuel facility is available on the Airport at 81 North Service Road.
Where new alternative fuel vehicles (AFVs) are developed and determined to be cost effective and in available supplies, Delta Air Lines will integrate their use into its Terminal A GSE fleet operations.	**Implemented.** As described earlier, Delta Air Lines has purchased electric baggage tugs and belt loaders and will continue to determine the feasibility of integrating other alternative fuel GSE, as available.
Finally, Delta Air Lines will provide Massport with an annual status report/update on the GSE conversion program at Terminal A, for inclusion in Massport's annual Environmental Data Report (EDR).	**Implemented.** Terminal A includes 32 electric charging stations for Delta Air Lines' electric ramp vehicles. Delta Air Lines continues to study which AFVs and infrastructure are best suited for its future GSE operations.
Operational Mitigation Measures *Minimizing nighttime movement of aircraft to and from hardstand positions.*	**Implemented.** In accordance with the Noise Rules, Massport continues to restrict nighttime movement of aircraft under their own power between 10:00 PM and 7:00 AM, and Massport also requires towing during this time period.

Table 9-4 Replacement Terminal A Project Status Report (EOEA #12096) Section 61 Mitigation Measures (as of December 31, 2014) (Continued)

Mitigation Measure	Status
Using single engine taxiing and pushback to the extent feasible and practicable, recognizing that such use always at the discretion of the pilot in charge of the aircraft based upon his or her experience and safety and operational considerations.	**Implemented.** Massport has conducted two surveys of Logan Airport air carriers (2006 and 2009) to understand the extent single engine taxiing is used at Logan Airport. Massport also issued letters to air carriers in support of single engine taxiing when consistent with safety procedures. Massport is an active member of the Federal Aviation Administration (FAA) Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by the Massachusetts Institute of Technology (MIT) of a more detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010 (as provided in the *2010 Environmental Data Report [2010 EDR]*). The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. Based on the more detailed survey results, Massport will tailor future communication to airlines to further encourage the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. In 2014, Massport sent letters to the Boston Airline Community and the Logan Airport user community encouraging them to consider the use of single engine taxiing when safe to do so. This is provided in *Appendix L, Reduced/Single Engine Taxiing at Logan Airport Memoranda* of this *2014 EDR.*
Testing alternative de-icing methods to reduce the amount of glycol usage.	**Ongoing.** Delta Air Lines is currently using sodium formate, an environmentally friendly deicing material, for pavement deicing.

Source: Massport
Note: Text in italics detailing the mitigation measures is excerpted from the Section 61 Findings submitted to the EEA, August 31, 2001.
1 Details are available in the Section 61 Findings.

Logan Airside Improvements Planning Project – EOEA #10458

Permitting History

- Certificate on the Final EIR issued on June 15, 2001.
- Section 61 Findings dated June 8, 2001 on the Final EIR.
- In June 2002, the Federal Aviation Administration (FAA) filed a Final Environmental Impact Statement (FEIS) and issued the Record of Decision (ROD) in August 2002 approving a unidirectional runway and other improvements, but deferred a decision on the centerfield taxiway pending additional review by the FAA.
- In November 2003, the Superior Court of the Commonwealth modified a 1976 injunction prohibiting construction of a new runway at Logan Airport, pending further environmental review. The injunction modification allowed construction of the runway in accordance with the MEPA Certificate on the Final EIR and the FAA's ROD on the Final EIS.
- In accordance with the Secretary of EEA's Certificate on the Final EIR, Massport amended its final Section 61 Findings issued in 2001 to incorporate mitigation measures added or refined through the federal environmental review process. As a result, Massport amended its initial Section 61 Findings on October 21, 2004, to include mitigation measures required of it in the FAA's ROD.
- In April 2007, the FAA issued a ROD on the centerfield taxiway improvements based on its review of supplemental information.

Project Status

- Project construction commenced in 2004. Runway 14-32 opened on November 23, 2006. 2007 was the first full year of operation of Runway 14-32.
- Realignment of the southwest corner taxiway system was completed in 2007.
- Taxiway D extension was completed in 2010.
- Taxiway N realignment is anticipated to commence after 2015.
- Reduction in approach minimums on Runway 15R and 33L was implemented in 2013 following completion of the 33L Light Pier replacement and FAA testing of new Instrument Landing System (ILS) equipment.

The Logan Airside Improvements Planning Project (Figure 9-4) involved the construction of a new unidirectional Runway 14-32 and centerfield taxiway, extension of Taxiway D, realignment of Taxiway N, improvements to the southwest corner taxiway system, and reduction in approach minimums on Runways 22L, 27, 15R, and 33L. Reduction in approach minimums on Runway 15R and 33L were approved in the EIS. However, implementation for approach minimum reductions depended upon realignment of the ILS. The construction impacts of relocating the ILS localizer and new CAT III ILS equipment were addressed in the environmental review of the RSA enhancements for Runway 33L (EOEA #14442). The CAT III ILS began operations in 2013.

Table 9-5 summarizes the mitigation measures contained in the amended Section 61 Findings issued on October 21, 2004 and reports on the status of implementation. Table 9-5 addresses only ongoing requirements, and it is noted when there are recent updates. Documentation on design and construction measures is contained in previous EDRs.

Figure 9-4 Logan Airside Improvements

Note: Runway 14-32 construction completed in November, 2006.

Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014)

Mitigation Measures	Status
Runway 14-32 Operations and Construction Mitigation	
Operational procedures for unidirectional Runway 14-32 will include over water flight operations only, arrival operations in east-to-west direction from Runway 32 approach end, and departure operations from west-to-east direction from the Runway 14 departure end. Massport will enter into contract with appropriate government body and/or community group(s) to enforce intended unidirectional runway, if requested. Lighting, marking, and instrumental components of Runway 14-32 will be designed for a unidirectional runway. No parallel or other type taxiway facility will be constructed to allow east-to-west direction departures from the Runway 32 end. *The Federal Aviation Administration (FAA) endorsed the unidirectional limitations on Runway 14-32 and has agreed to develop air traffic control procedures to ensure safe and efficient operation of the unidirectional limitation, subject to variances that may be required to accommodate particular aircraft emergencies.*	**Implemented.** Runway 14-32 was constructed for unidirectional operation. All lighting, marking, and navigational instrumentation was constructed and is operated for unidirectional use only. There is no parallel or other type of taxiway facility that would facilitate east-to-west direction departures from the Runway 32 end. The construction mitigation measures were incorporated into the final design specifications and were implemented during construction. Runway 14-32 opened on November 23, 2006.
Wind-Restricted Use of Runway 14-32 Restrict the use of Runway 14-32 to those times when winds are equal to or greater than 10 knots from the northwest or southeast (between 275 degrees and 005 degrees, or 095 degrees and 185 degrees, respectively).	**Implemented.** Massport provided initial data to support FAA's effort. The FAA implements the wind restriction in compliance with the federal Record of Decision (ROD).
Mitigation Policies/Programs	
Regional Transportation Policy *Engage in promoting increased utilization of regional airports* *Cooperative transportation planning with the various transportation agencies to ensure an integrated regional transportation infrastructure (i.e., improved highways, public transportation, high-speed rail, private transportation services to improve regional airport access).*	**Implemented.** During 2001, Massport, together with the FAA and the six New England Regional State Aviation Directors developed a scope of work and selected a technical team to undertake the New England Regional Aviation System Plan (NERASP) Update study. In 2002, the Massport Board approved 10 percent funding with a 90 percent federal match toward the $1.6 million study. Please refer to *Chapter 4, Regional Transportation*, for additional information on Massport's cooperation on regional transportation efforts.
Massport will continue to exercise operational control over Worcester Regional Airport.	**Implemented.** The Authority exercised operational control over Worcester Regional Airport as part of Massport's agreement with the City of Worcester which went into effect on January 15, 2000. In April 2004, Massport and the City of Worcester agreed to a three-year extension of the Operating Agreement, extending Massport's operation of the Airport through June 2007. Subsequently, both parties agreed to a further extension. Legislation was passed in 2009 requiring Massport to assume ownership of Worcester Regional Airport. Massport's ownership of Worcester Regional Airport commenced on July 1, 2010.

**Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)**

Mitigation Measure	Status
Massport will continue to attract new air service to Worcester Regional Airport	**Implemented.** Following the events of September 11, 2001, the last commercial operator, US Airways Express, ceased operations out of Worcester in early 2003. In 2003 and 2004, Massport continued to work with the City to attract passenger service for the Worcester Regional Airport. Service by Allegiant Airways commenced in December 2005 but ceased in September 2006. Commercial passenger service was regained when Direct Air began scheduled charter services in November 2008, but commercial passenger services ceased again in 2012. Massport continues to work with carriers and make other facility improvements to develop and sustain commercial service from Worcester. In 2013, JetBlue Airways began commercial service to two Florida locations from Worcester Regional Airport; as of this filing, over 200,000 passengers have been served.
Traveler and air service awareness will be provided to Worcester Regional Airport via marketing campaigns.	**Implemented.** Massport continues to aggressively market the Airport to potential commercial air service carriers. Massport worked with JetBlue Airways to begin service out of Worcester Regional Airport in November 2013.
Develop and maintain an aviation information database to include: aviation trend tracking reports for distribution to interested parties; statistical summaries of passenger levels, aircraft operations and airline schedule data at major New England regional airports; include a summary of regional airport trends and service developments an Annual Report.	**Implemented.** Massport collects regional airport data. A summary of individual airport activity is published annually in the Environmental Data Reports (EDR), and in the Environmental Status and Planning Reports (ESPR).
Participate in other regional/state aviation forums.	**Implemented.** The NERASP study was completed in the fall of 2006. Massport continues to participate in regional and state aviation forums as they exist. Please refer to *Chapter 4, Regional Transportation*, for additional information on Massport's cooperation on regional transportation efforts.
Continue to work with FAA/regional airport directors to complete a New England Airports System Study to evaluate regional airports performance. FAA committed to work with other participants in the preparation of the study.	**Implemented.** The NERASP Study was published in October 2006.
Encourage transportation initiatives (i.e., commuter rail, rail or other links between regional airports) by relevant agencies or other governmental bodies through Transportation Bond Bill or other legislative initiatives to implement an improved effective regional transportation system.	**Implemented.** Massport continues to provide support for regional transportation legislation and funding for other modes of transportation including the MBTA Silver Line and water transportation. Massport's support was instrumental in the opening of the Anderson Regional Transportation Center (RTC) in Woburn which provides a station building for ticketing, baggage and passenger services, approximately 2,400 parking spaces for daily and overnight parking, loading platforms for Logan Express and local buses, improved access from Interstate 93 via a new interchange constructed and opened by the Massachusetts Department of Transportation (MassDOT, formerly the Massachusetts Highway Department) and a new high-level platform commuter rail station.

**Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)**

Mitigation Measure	Status
Continue to support inter-city rail planning through the Boston Metropolitan Planning Organization (MPO).	**Implemented.** Massport continues to actively participate in the Boston MPO and contributes to the policy discussions in all modes of transportation.
Allow Massport's Logan Express satellite parking lots and stations available for third-party bus and park-and-ride connections to other regional airports, including Worcester, Manchester, and Providence.	**Implemented.** Upon request and review, Massport will continue to allow third party bus operators to provide service to regional airports from Logan Express facilities. In 2007, Massport enacted an agreement with Manchester-Boston Regional Airport to allow operation of a shuttle service between Manchester- Boston Regional Airport and the RTC in Woburn. That pilot program was replaced by hourly van service in 2008.
Sound Insulation	
Sound insulation is being provided within the Boston Logan Airside Improvements Planning Project Mitigation Contour including the affected residences of Chelsea, East Boston, Winthrop, and Revere. Through special project mitigations, FAA funding will be provided for residences with building code considerations to allow for the necessary upgrades thereby ensuring eligibility and participation in the sound insulation program. If FAA funding is unavailable to complete sound insulation to residences within the DNL 65 dB contour as a result of project implementation, Massport will provide the funding." See Chapter 6, Noise Abatement for additional details on Sound Insulation.	**Implemented.** Sound insulation is being implemented in full compliance with state and federal regulatory requirements and mitigation commitments. Since 1986, Massport has sound insulated nearly 6,000 residential buildings totaling over 11,515 dwelling units.
Preferential Runway Advisory System (PRAS)	
Massport will develop and implement a PRAS monitoring system and a new distribution system for reporting that will expand the contents of Massport's Quarterly Noise Reports and will involve the expansion of the distribution list to include the Logan Airport Citizens Advisory Committee (CAC). Runway utilization, dwell, and persistence reports will be included in the ESPR filings with MEPA. Massport will continue to work with FAA to design additional reports to enhance the attainment of PRAS and Massport will begin to work with CAC to update PRAS. The current PRAS system will remain in place until superseded.	**Implemented.** Massport, FAA, and the CAC initiated a noise study of Logan Airport. PRAS review and reporting are incorporated into the noise study. During Phase 2 of the on-going Boston Logan Airport Noise Study (BLANS) the Logan Airport Community Advisory Committee (CAC) voted to abandon PRAS because it had not achieved the intended noise abatement. For additional information, refer to *Chapter 6, Noise Abatement*. Runway utilization, dwell and persistence reports continue to be included in the annual ESPR and EDR filings.
Noise Abatement Study *FAA has committed to undertake a noise abatement study that will include enhancing existing or developing new noise abatement measures applicable to aircraft overflight impacts, which will take into account environmental benefit, operational impact, aviation safety and efficiency, and consistency with applicable legal requirements. The scope of this study has been completed through the joint efforts of FAA, the CAC, and Massport as required by the ROD. Massport will work with the CAC and FAA to assess the existing PRAS at Logan Airport in accordance with Section 10.0 of the Section 61 Findings and will continue to participate in the noise study as contemplated in the ROD.*	**Implemented.** The FAA, in conjunction with Massport and the Logan Airport CAC, initiated the Boston Overflight Noise Study (BONS). Phase 1 of the study, completed in early 2007, defined and will seek to implement changes to flight tracks to minimize impacts from aircraft overflights which do not require a detailed Environmental Assessment (EA). Federal funding for Phase 2 was requested early to ensure seamless continuation of the study and transition. Phase 2, of the Boston Logan Airport Noise Study (BLANS), was completed in 2012. It addressed additional noise abatement alternatives that will require detailed analysis to meet FAA environmental requirements. FAA has begun implementing new aRea NAVigation (RNAV) procedures that were designed in Phase 1. Please refer to website www.bostonoverflight.com for more details.

**Table 9-5 Logan Airside Improvements Planning Project (EOEA #10458)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)**

Mitigation Measure	Status
Peak Period Monitoring and Demand Management Program (DMP) *Massport will develop and implement a Peak Period Pricing (PPP) program or an alternative DMP. Massport will identify standards to allow airlines to accurately predict scheduling costs and modify accordingly. Massport will establish and maintain a monitoring system.* *Massport will comply with its commitments with respect to PPP or alternate DMP. FAA has indicated in the ROD that it stands ready to assist Massport in this endeavor.*	**Implemented.** In July 2004, Massport filed a proposed rule with the Office of the Massachusetts Secretary of State to formally initiate the state rulemaking process and public review of a proposed rule to establish a peak period surcharge during designated peak delay periods at Logan Airport. The filing was followed by a public comment period that lasted through November 15, 2004. During the comment period, Massport conducted two public hearings to receive comments on the proposed regulation. The Massport Board voted to establish the peak period surcharge program on January 16, 2005. The program has been in place since that date. Please refer to *Appendix K, 2014 Peak Period Pricing Monitoring Report.*
Single Engine Taxi Procedures *Develop and implement a program designed to maximize the use of single engine procedures by all tenant airlines, consistent with safety requirements, pilot judgment and Federal law requirements.*	**Implemented.** Massport supports the use of single engine taxiing when it can be done safely, voluntarily and at the discretion of the pilot. Massport has conducted two surveys of Logan Airport air carriers (2006 and 2009) to understand the extent single engine taxiing is used at Logan Airport. Massport also issued a letters to air carriers in support of single engine taxiing when consistent with safety procedures. Massport is an active member of the FAA Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) program on reducing noise and emissions. In 2009, Massport offered to facilitate the undertaking by MIT of a more detailed survey of pilots at Boston Logan Airport to better understand the use of single engine taxiing. MIT completed its survey and issued a paper in March 2010 (as provided in *Appendix L, Demonstration of Reduced Airport Congestion through Pushback Rate Control* of the *2011 ESPR*). The MIT survey confirms earlier Massport survey findings that single engine taxiing is an important operational measure used by airlines to conserve fuel and is extensively used at Logan Airport. In 2014, Massport issued letters to air carriers in support of single engine taxiing when consistent with safety procedures. A copy of these letters is included in *Appendix L, Reduced/Single Engine Taxiing at Logan Airport Memoranda of this 2014 EDR.*
Report on Progress of Logan Transportation Management Association (TMA)	**Implemented.** *Chapter 5, Ground Access to and from Logan Airport* of the *2011 ESPR* discusses the status of the Logan TMA and efforts to increase Logan TMA membership and overall high occupancy vehicle (HOV) access to Logan Airport. Since MassRIDES began management of the Logan TMA in January 2006, the joint focus has been on expanding Logan TMA services, broadening HOV options, and supporting all major Logan Airport tenants to become members and actively participate in the Logan TMA. In 2007, the Logan TMA implemented three new programs: Sunrise Shuttles; Logan TMA Preferential Carpooling; and Commuter Cash program.

Source: Massport
Note: The mitigation measures in italics are those that were referenced in the FAA's ROD and later incorporated into the October 21, 2004 amended Section 61 Findings.

Southwest Service Area (SWSA) Redevelopment Program, EOEA # 14137

Permitting History

- Certificate on the Final EIR issued on May 28, 2010
- Section 61 Findings submitted to EEA on June 29, 2010

Project Status

Massport is redeveloping the SWSA and has completed the new RCC. In addition to customer service benefits, consolidation of the rental car operations and their shuttle buses into one coordinated operation will result in reduced vehicle miles traveled (VMT) and associated air emissions. See *Chapter 5, Ground Access to and from Logan Airport*, for additional information on VMT reductions.

Construction of enabling projects commenced in late summer 2010 as final design of the facility continued through 2011. All RCC facilities (the Garage Structure, Customer Service Center (CSC), permanent Quick Turnaround Areas (QTAs) 1 and 2, and temporary QTAs 3 and 4) would be constructed first. The first rental car companies moved into the QTA 1 in mid-2013 and the remaining companies by early 2014. By the end of 2015, the entire project will be completed and operational. Table 9-6 outlines the SWSA Redevelopment Program Section 61 commitments which Massport, the construction contractors, and the rental car companies will implement as part of the design, construction and operation of the facility. This project is now complete and there is updated progress for each mitigation measure.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014)

Mitigation Measure	Status
Site Design	
Stormwater Management	
Improve quality of runoff by upgrading stormwater management facilities site-wide, reducing the volume of flow to the Maverick Street Outfall by increasing pervious area site-wide, utilization of Low Impact Design elements, and replacing uncovered parking areas with buildings.	**Implemented.** These stormwater design features were included in the final project design and are part of the project. The stormwater features include 27 stormceptors that were constructed as part of this project. Stormceptors are prefabricated, underground units that separate oils, grease, and sediment from stormwater runoff when installed as part of a pipe conveyance system.
Design new sanitary and drainage systems to result in an overall reduction in combined sewer overflow volumes at the Porter Street Outfall and eliminate discharge to Maverick Street Outfall and Bird Island Flats/West Outfall.	**Implemented.** The sanitary sewer system designed for the RCC project adds new connections at Gove Street and Harborside Drive. Sanitary flows to the Maverick Street sewer will be significantly reduced once the connection is completed. Massport submitted a pre- and post-development stormwater analysis with the Notice of Intent (NOI) for the RCC project, as required by the Massachusetts Department of Environmental Protection's (MassDEP's) Stormwater Management Regulations. The stormwater analysis shows an overall reduction in the post- development stormwater flows for the project, as well as reductions in flows to the Porter Street and West Outfalls and elimination of stormwater flow to the Maverick Street Combined Sewer. Both the sanitary sewer system and stormwater drainage system are completed.
Remediation and Underground Fuel Storage Systems	
Remove all existing car rental fueling systems and associated tanks and replace with current, state-of-the-art vehicle fueling and washing facilities.	**Implemented.** This element has been implemented as part of the quick turnaround facilities.
Develop a Soil Management Plan and submit to the MassDEP prior to construction for the Activity and Use Limitations (AUL) areas.	**Implemented.** As required by the RCC project specifications, the Project Contractor submitted an Excavated Materials Management & Disposal Plan prepared by a Licensed Site Professional (LSP) and submitted it on March 25, 2011 for Massport review and approval. Two Release Abatement Measure (RAM) Plans for work within AUL areas were submitted by the Contractor's LSP to MassDEP in accordance with the Massachusetts Contingency Plan (MCP). Construction occurred within two AUL areas, associated with MCP sites identified by Release Tracking Number (RTNs) 3-00956 and 3-2690, and submittal of the RAM Plans were required to detail procedures for managing contaminated soil. RAM Status Reports have been submitted on a 6-month schedule documenting soil management activities, and electronic files of these reports can be accessed by searching the RTNs on the MassDEP website.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)

Mitigation Measure	Status
Noise Reduction Measures	
Eliminate individual rental car shuttle buses and combine Massport Airport Station buses (routes 22/33/55) through the Unified Bus System; thereby, reducing the overall number of rental car-related buses circulating on-airport and associated noise.	**Implemented.** Massport purchased a new Bus Fleet which was put into operation in 2012. The bus fleet is comprising 18 compressed natural gas (CNG) buses and 32 clean diesel/electric buses that have already replaced Massport's older fleet of 26 CNG buses and have replaced the entire fleet of diesel rental car shuttle buses with the RCC opening in 2013. Four additional CNG buses were put into service in September 2015, bringing the total to 22 buses.
Incorporate noise reduction strategies into site design, such as solid fences/walls, gateway signs/walls, and landscaped berms.	**Implemented.** This element was completed.
Phase 2 SWSA Airport Edge Buffer and Other Site Landscaping	
Construct other site landscaping that encourages walking/biking by providing safe and welcoming corridors, reduces environmental impact (water efficient; reduce and filter runoff), and screens the SWSA from neighboring properties.	**Implemented.** This element is included in the final design and will be part of the completed project, which is under construction and set to be completed by the end of 2015.
Building Design	
Energy Efficiency	
Optimize daylight and natural ventilation within the Garage Structure (a Code classification for an "open parking structure") to eliminate the need for substantial mechanical ventilation systems.	**Implemented.** This element is included in the completed project.
Reduce energy consumption by a minimum of 20 percent (as required by MA LEED Plus) by properly sizing building mechanical systems and incorporating high performance/energy efficient mechanical and electrical building systems, such as highly-reflective (high-albedo) roofing materials, reduced lighting intensities, high-efficient heating and cooling systems, and daylighting techniques with window and skylight glazing.	**Implemented.** This element is included in the completed project.
Reduce overall electricity consumption by 2.5 percent through the use of on-site renewable energy (which contributes to the overall 20 percent energy efficiency performance criteria above).	**Implemented.** This element is included in the completed project.
Conduct a third-party commissioning process to ensure the effectiveness of building systems (as required by MA LEED Plus).	**Implemented.** Third party commissioning is planned upon building completion.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137)
Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)

Mitigation Measure	Status
Water Efficiency and Wastewater Reduction	
Reduce water use demand by a minimum of 20 percent (as required by MA LEED Plus) and to strive for a 30 percent reduction through utilization of high-efficiency/ low-flow plumbing fixtures and car wash water reclamation systems.	**Implemented.** This element is included in the completed project.
Reduce water use demand and wastewater generation by reclaiming and reusing car washing water.	**Implemented.** This element is included in the completed project.
Potential collection of and reuse of stormwater runoff for irrigation of landscaped areas.	**Not implemented.** This element is was considered as part of the final design. A rain garden was not included in the final design as a method to control stormwater runoff due to financial and environmental challenges.
Noise Reduction Measures	
Improve the Quick Turnaround Areas (QTAs), including the elimination of outdoor loudspeakers, elimination of car drying blowers through state-of-the-art equipment, enclosed vacuum compressors, and incorporation of six to eight-foot high solid walls/fences designed to further reduce noise from activities at the QTA facilities, including car washing and vehicle movements.	**To be implemented.** This element is included in the completed project.
Transportation and Parking	
Roadway Improvements	
Reconstruct Porter Street, including turnaround for exiting taxis.	**To be implemented.** This element is included in the completed project.
Reconfigure SR-14 and new alignment of Ramp 1A-S.	**Implemented.** This element is included in the final design and the completed project.
Construct new dedicated Unified Bus System access and ramp off of SR-14.	**Implemented.** This element is completed.
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Porter Street intersection.	**Implemented.** This element is included in the final design and the completed project.
Reconstruct, widen and convert Jeffries Street to one-way northbound, between Harborside Drive and Tomahawk Drive.	**Implemented.** This reconfiguration is complete.
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Jeffries Street intersection.	**Implemented.** This element is completed.
Construct the extension of Tomahawk Drive –a one-way westbound roadway connecting Harborside Drive with the Maverick Street Gate and Garage Structure.	**Implemented.** This element is completed.

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)

Mitigation Measure	Status
Reconstruct traffic signals and pedestrian accommodations at the Harborside Drive/Hotel Drive intersection.	**Implemented.** This element is completed.
Reconfigure inbound lane of the Maverick Street Gate to provide additional queue storage.	**Implemented.** This element is completed.
Airport Transportation System Improvements	
Reduce the rental car shuttle bus fleet by approximately 70 percent through the creation of the Unified Bus System when compared to the 2007 Existing Condition and future No-Build/No-Action Conditions.	**Implemented.** Massport purchased a new Unified Bus Fleet of diesel/electric hybrid and CNG buses. The initial buses were put into operation in 2012. Full implementation of the new bus fleet occurred when the RCC opened in the fall of 2013.
Reduce rental car shuttle bus terminal curbside congestion through the creation of the Unified Bus System resulting in reduced emissions.	**Implemented** upon project opening. Massport purchased a new Unified Bus Fleet which was put into initial operation in 2012.
Utilize clean- and low-emission fuel for the Unified Bus System to further reduce emissions.	**Implemented** upon project opening. Massport has purchased a new Unified Bus Fleet. The new fleet is comprised of diesel/electric hybrid and CNG buses.
Install Intelligent Transportation System features, as part of the Unified Bus System to further reduce emissions and improve operational efficiency.	**Implemented** upon project opening. Massport purchased a new Unified Bus Fleet which was put into initial operation in 2012.
Implement new wayfinding signage to increase the efficiency of the circulating vehicles within and around the SWSA.	**Implemented** upon project opening.
Pedestrian and Bicycle Facilities	
Provide new pedestrian and bicycle facilities, including secure and covered bicycle storage at the Customer Service Center (CSC) and QTA buildings for employees, customers and the general public, as well as shower/changing facilities within the QTA buildings for employees.	**To be implemented.** This element is completed.
Provide enhanced pedestrian connections to and from the SWSA, airport terminals, the Logan Office Center, Memorial Stadium Park, Bremen Street Park, the Harborwalk, on-airport buses, public transit (MBTA Airport Station), along Porter Street, and surrounding East Boston neighborhoods.	**To be implemented.** This element is completed.
Provide street and pedestrian-level lighting and advanced warning signals and/or systems at crosswalks.	**To be implemented.** This element is completed.
Transportation Demand Management (TDM) Plan	
Provide limited SWSA employee parking on-site.	**Implemented.**

Table 9-6 Southwest Service Area (SWSA) Redevelopment Program (EEA # 14137) Details of Ongoing Section 61 Mitigation Measures (as of December 31, 2014) (Continued)

Mitigation Measure	Status
Provide new access to public transit through the Unified Bus System (direct connection to MBTA Blue Line at Airport Station) and new/enhanced pedestrian facilities at the station.	**Implemented.**
Require rental car companies to participate in the Logan Transportation Management Association (TMA).	**Implemented.** This requirement is included in new RCC tenant leases.
Alternative-Fuel Vehicles	
The rental car companies would provide fuel-efficient and/or alternative-fueled rental vehicles (quantity to be determined by the rental car companies).	**Implemented.** This requirement is included in new RCC tenant leases.
Off-Airport Improvements/Benefits	
Reconstruct Frankfort Street/Lovell Street intersection to provide a new traffic signal control and pedestrian-related improvements (for temporary impacts of the relocation of the Bus and Limousine Pools to the North Service Area (NSA) during construction).	**Implemented.** This element is completed.
Reduce the amount of off-airport car shuttling to and from off-airport locations, further reducing traffic on Route 1A and local roadways surrounding the airport due to the consolidated and expanded rental car "ready/return" parking spaces and QTA areas at the SWSA.	**Implemented** upon project opening.
Construction Management	
Aim to divert/reduce construction waste to landfills.	**Implemented during construction**
Implement Erosion and Sedimentation Control Program.	**Implemented during construction**.
Retrofit certain diesel construction equipment types with diesel oxidation catalyst and/or particulate filters (in accordance with the DEP Clean Air Construction Initiative).	**Implemented during construction**
Require the use of ultra-low sulfur diesel fuel for off-road construction vehicles and/or equipment.	**Implemented during construction**
Construction worker vehicle coordination and trip limitation, including requiring contractors to provide off-airport parking and use of high-occupancy vehicle transportation modes for employees.	**Implemented during construction**
To ensure no changes in the conditions of abutting homes due to pile driving, Massport will require the Contractor to inspect the conditions of the abutting homes prior to and following pile driving activities.	**Implemented.** Preconstruction residential survey completed.

Source: Massport

Logan Airport RSA Project – EEA #14442

Permitting History

- Certificate on the Final EA/EIR issued on March 18, 2011.
- The FAA issued a Finding of No Significant Impact (FONSI) on April 4, 2011, which documents that the proposed Federal action is consistent with the National Environmental Policy Act of 1969 (NEPA) and other applicable environmental requirements and will not significantly affect the quality of the human environment with the mitigation requirements referenced in Table 9-7.
- Section 61 Findings were submitted to EEA on May 27, 2011, and published in the *Environmental Monitor* on June 8, 2011.
- Certificate on the Notice of Project Change (NPC) for the replacement of the Runway 33L approach light pier issued on March 9, 2012.
- On April 12, 2012 the FAA found that the replacement of the Runway 33L approach light pier was a Categorical Exclusion and thus exempt from further consideration under NEPA.

Project Status

- The first construction season for the Runway 33L RSA commenced in June 2011 and ended in November 2011. The second construction season started in June 2012 and the project was completed in November 2012.
- Replacement of the Runway 33L approach light pier commenced in July 2012 and was completed in November 2012. The upgraded CAT III system was put in service in 2013.
- The Runway 22R improvements were completed in 2014.

As described in previous EDRs/ESPRs, Massport has periodically undertaken RSA improvement projects at other Logan Airport runways. Massport has completed safety improvements for Runways 22L, 4L/4R, and 27 under EEA #5122. In 2005, Massport began undertaking safety improvements at Runway 22R with the construction of an Engineered Materials Arresting System (EMAS) bed at the end of the runway in compliance with FAA directives, although no MEPA review was needed. In 2006, as part of a separate project, Massport installed an EMAS bed at the Runway 33L End. The current project, the Logan Airport RSA Project, considered further enhancements to the Runway 33L and Runway 22R RSAs. Massport prepared a combined EA in accordance with NEPA and an EIR in accordance with MEPA for the proposed enhancements at the Runway 33L and Runway 22R RSAs. The ENF was filed with MEPA on June 30, 2009, and the Draft EA/EIR was submitted to FAA and EEA on July 15, 2010. The Final EA/EIR was submitted to FAA and EEA on January 30, 2011. Figure 9-5 indicates the status of RSA projects at Logan Airport.

The Runway 33L RSA improvements include a 600-foot long RSA with an EMAS bed, portions of which are on a 460-foot long by 303-foot wide pile-supported deck extending over Boston Harbor. Additional elements of the RSA improvements include two emergency access ramps located on either side of the deck and relocation of the perimeter access road. Construction of the pile-supported deck was completed in November, 2012.

The current Runway 33L RSA project replaced the inner 500 feet of the light pier. As construction progressed on the Runway 33L RSA improvements, Massport determined that it would be feasible to replace the remaining Runway 33L approach light pier. In summer of 2012, Massport began replacing the outer approximately 1,900 feet of the existing timber light pier that extends approximately 2,400 feet southeast of Runway End 33L. The existing timber pier was replaced with a new concrete structure along the runway centerline, approximately 10 feet south of the old pier, using concrete pilings. The in-kind replacement reduced the total number of pilings significantly (from over 500 to approximately 150). As part of the reconstruction, the new light pier was also constructed to accommodate upgraded navigational aids. The pier improvements provide the infrastructure necessary to support navigational aids that facilitated implementation of the reduced aircraft approach minimums previously reviewed and approved by the FAA in a ROD dated August 2, 2002, for the *Logan Airside Improvements Planning Project (Airside Project)*. Massport filed a NPC with MEPA for the proposed light pier replacement on January 31, 2012. On March 9, 2012, the EEA Secretary issued an NPC Certificate determining that no further MEPA review was required for the light pier replacement. On April 12, 2012 the FAA found that the replacement of the Runway 33L approach light pier was eligible for a Categorical Exclusion and thus exempt from further review under NEPA.

The Runway 22R improvements that were completed in 2014 enhanced the existing RSA at this location by constructing an inclined safety area (ISA), similar to the ISA constructed at the Runway 22L end. Construction of the Runway 22R ISA is completed. Table 9-7 lists the Section 61 commitments for the Logan Airport RSA Project and Massport's progress in achieving these measures.

Figure 9-5 Runway End Safety Improvements

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented (as of December 31, 2014)

Mitigation Measure	Status
Protected Resources	
Eelgrass	
Develop a mitigation program that will replace lost eelgrass area and functions by creation of new eelgrass, at a 3:1 replacement to loss ratio.	Implemented. Eelgrass was transplanted in 2011, but did not survive through 2012. In 2012, Massport continued to work with the Eelgrass Mitigation Working Group (comprised of federal, state, and local agencies) through 2013 to identify alternative means of eelgrass mitigation. In 2013, state and federal agencies agreed that Massport's implementation of a conservation mooring program would be a suitable replacement alternative to the initial eelgrass transplantation. In 2015, Massport completed replacement of nearly 240 traditional moorings in eelgrass with conservation moorings in Boston and four other Commonwealth harbors.
Implement sediment control measures during construction.	Implemented. Sedimentation control measures were installed and fully maintained.
Store construction barges outside of any eelgrass beds overnight during construction.	Implemented. There was no overnight barge storage in or immediately adjacent to eelgrass beds.
Restrict barge movement to designated construction corridors outside of the eelgrass bed during construction.	Implemented. There was limited barge movement in or immediately adjacent to eelgrass beds.
Provide post-construction monitoring and restoration or any additional areas of eelgrass beds that are inadvertently damaged during construction.	Implemented. The post-construction monitoring was conducted in November, 2012.
Salt Marsh	
Restore new salt marsh at a 2:1 replacement to loss ratio.	Implemented as part of Runway 22R habitat mitigation at Rumney Marsh.
Monitor compensatory salt marsh for success and invasive plant species, and implement an invasive species control plan.	To be implemented as part of Runway 22R habitat mitigation at Rumney Marsh.
Implement erosion and sedimentation control measures according to the Soil Erosion and Sediment Control Plan.	Implemented during construction.
Shellfish	
Monitor pilings and substrate at Runway 33L.	Implemented. Monitoring conducted summer 2013, 2014, and 2015.
Restore approximately 1.1 acres of habitat.	Implemented as part of Runway 22R habitat mitigation at Rumney Marsh.
Harvest and transplant shellfish from the footprint of the Runway 22R Inclined Safety Area (ISA).	The MA Division of Marine Fisheries (MassDMF) has identified a risk of shellfish disease in the Logan Airport flats, including 22R and has determined that the shellfish should not be relocated.
Execute Memorandum of Agreement with the Massachusetts Division of Marine Fisheries for resource enhancement.	Implemented. A Memorandum of Agreement (MOA) with MassDMF was executed on July 30, 2012 and the requirements of the MOA have been implemented.

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented (as of December 31, 2014) (Continued)

Mitigation Measure	Status
State-Listed Rare Species	
Identify equivalent area of pavement for removal to maintain area of available habitat at Logan Airport for the upland sandpiper if required by the Massachusetts Natural Heritage and Endangered Species Program.	**To be implemented.** The Massachusetts Natural Heritage & Endangered Species Program (NHESP) has determined that construction time of year restrictions will avoid impacts to state-listed species. These seasonal restrictions will be implemented when construction of Taxiway C-1 is initiated in the future.
Cultural Resources	
Develop an Unanticipated Discovery Plan in accordance with the Board of Underwater Archaeological Resources' Policy Guidance	**Implemented.** An Unanticipated Discovery Plan was developed in accordance with the Board of Underwater Archaeological (BUA) Resources' Policy Guidance and approved by BUA. No resources were discovered during Runway 33L construction.
Water Quality	
Develop and implement a comprehensive Soil Erosion and Sediment Control Plan in accordance with NPDES and MassDEP standards.	**Implemented.** A comprehensive Soil Erosion and Sediment Control Plan was developed and implemented at the outset of Runway 33L construction in June 2011 and maintained through the end of construction in 2012.
Apply water to dry soil to prevent dust production.	**Implemented.** Completed for Runway 33L and 22R construction.
Stabilize any highly erosive soils with erosion control blankets and other stabilization methods, as necessary.	**Implemented.** Completed for Runway 33L and 22R construction.
Use sediment control methods (such as silt fences and hay bales) during excavation to prevent silt and sediment entering the stormwater system and waterways.	**Implemented.** Completed for Runway 33L and 22R construction.
Maintain equipment to prevent oil and fuel leaks.	**Implemented.** Completed for Runway 33L and 22R construction.
Use silt curtains and semi-permanent (overnight) debris booms and other secondary booms and silt fencing around barges for additional containment.	**Implemented.** Completed for Runway 33L and 22R construction.
Contain and pump slurry and/or silty water to a containment area on a construction barge to contain runoff	**Implemented.** Completed for Runway 33L and 22R construction.
Noise	
Maintain mufflers on construction equipment.	**Implemented.** Completed for Runway 33L and 22R construction.
Keep truck idling to a minimum in accordance with Massachusetts anti-idling regulations.	**Implemented.** Completed for Runway 33L and 22R construction.
Fit any air-powered equipment with pneumatic exhaust silencers.	**Implemented.** Completed for Runway 33L and 22R construction.
Do not allow nighttime construction.	**Implemented.** Completed for Runway 33L and 22R construction.
Air Quality	
Keep truck idling to a minimum in accordance with Massachusetts anti-idling regulations.	**Implemented.** Completed for Runway 33L and 22R construction.
Retrofit appropriate diesel construction equipment with diesel oxidation catalyst and/or particulate filters.	**Implemented.** Completed for Runway 33L and 22R construction.

Table 9-7 Logan Airport Runway Safety Area Improvement Program (EEA # 14442) Section 61 Mitigation Commitments to be Implemented (as of December 31, 2014) (Continued)

Mitigation Measure	Status
Implement construction worker vehicle trip management, including requiring contractors to provide off-airport parking, use high-occupancy vehicle transportation modes for employees, and join the Logan TMA.	**Implemented.** Completed for Runway 33L and 22R construction. Contractors assemble offsite and access the airfield in shared vans. Contractors have access to Logan Airport Transportation Management Association (TMA) services through MassRIDES.
Traffic	
Limit construction traffic to federal or state highways, restricting the use of East Boston local roadways by construction vehicles.	**Implemented.** Completed for Runway 33L and 22R construction.
Implement construction worker vehicle trip management, including requiring contractors to provide off-airport parking, use high-occupancy vehicle transportation modes for employees, and join the Logan TMA.	**Implemented.** Completed for Runway 33L and 22R construction. Contractors assemble offsite and access the airfield in shared vans. Contractors have access to Logan TMA services through MassRIDES.

MEPA Appendices

- Appendix A – MEPA Certificates and Responses to Comments on the *2012/2013 Environmental Data Report*
- Appendix B – Comment Letters and Responses
- Appendix C – Proposed Scope for the *2015 EDR*
- Appendix D – Distribution List

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MEPA Certificates and Responses to Comments

- Secretary of the Executive Office of Energy and Environmental Affairs Certificates on the *Logan Airport 2012/2013 Environmental Data Report (EDR)* and Massport's Responses to Comments raised in the Certificate.
- Copies of Secretary of the Executive Office of Energy and Environmental Affairs Certificates issued for the reporting years 2004, 2005, 2006, 2007, 2008, 2009, 2010, and 2011.

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Secretary of the Executive Office of Energy and Environmental Affairs Certificate on the Logan Airport *2012/2013 Environmental Data Report* and Massport's Responses to Comments Raised in the Certificate

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February 6, 2015

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS ON THE 2012-2013 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2012-2013 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: December 10, 2014

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (MEPA) (M.G.L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

Background

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of the Massachusetts Port Authority's (Massport) long-range planning process. The ESPR provides a "big picture" analysis of the environmental impacts of current and anticipated levels of activities, and presents an overall strategy to minimize impacts. The ESPR is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments associated with project-specific Environmental

Impact Reports (EIR). The ESPR is generally updated on a five-year basis; the most recent ESPR for the year 2011 was filed in April of 2013. Environmental Data Reports (EDRs) (formerly referred to as Annual Updates) are filed in the years between ESPRs. During the review of the 2011 ESPR, Massport requested that the 2012 and 2013 EDRs be combined into one document. The 2012-2013 EDR is the subject of this review. Additionally, this Certificate contains a Scope for the 2014 EDR.

The 2012-2013 EDR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual and predicted passenger activity and aircraft operation levels in 2012 and 2013, and presents environmental management plans for addressing areas of concern. The technical studies in the 2012-2013 EDR include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality and environmental management. The 2012-2013 EDR updates and compares the data presented in the 2011 ESPR, and presents activity levels (including aircraft operations and passenger activity) and environmental conditions at Logan Airport for the calendar years 2012 and 2013. It also reports on the status of project mitigation.

Passenger levels at Logan Airport reached a new peak in 2013, exceeding the 2007 historic peak, while aircraft operations at Logan Airport remained well below the historic peak reached in 1998. The 2012-2013 EDR examines the effects of airlines operating much more efficiently with quieter fleets and flying more passengers per aircraft operation. As discussed in the 2011 ESPR, the 2012-2013 EDR anticipates further increases in activity levels and some increases in environmental impacts compared to recent years.

Scope for the 2014 EDR

General

The 2014 EDR should follow the general format of the 2012-2013 EDR status report. The 2014 EDR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide background information on the environmental policies and planning that form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport to provide context for reviewing agencies and the public. A1

The 2014 EDR should provide an update on conditions at Logan Airport for calendar year 2014, including passenger and aircraft operation activity levels. It should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate. It should provide a status report on Massport's proposed planning initiatives, projects, and mitigation measures. A2

The technical studies in the 2014 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2014 EDR must also A3

respond to those issues explicitly noted in this Certificate and the comments received on the 2012-2013 EDR.

A distribution list for the 2014 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan ESPR (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary. A4

Response to Comments

The 2014 EDR Responses to Comments section should address all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments chapter included in the 2012-2013 EDR is well-constructed and cross-referenced. I encourage Massport to use the same format in the 2014 EDR. A5

The majority of comments received on the 2012-2013 EDR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the 2014 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate. A6

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2012 and 2013. Logan Airport is New England's primary domestic and international airport, operating as an origin-destination airport, rather than a connecting hub for major airlines. In 2012, Logan Airport was the 23rd busiest commercial aviation facility in North America ranked by aircraft operations, and the 20th busiest in North America ranked by number of passengers. In 2013, Logan Airport was the 21st busiest commercial aviation facility in North America ranked by aircraft operations, and remained the 20th busiest in North America ranked by number of passengers.

The total number of air passengers at Logan Airport increased by 1.1 percent to 29.2 million in 2012 and by 3.4 percent to 30.2 million in 2013, compared to 28.9 million in 2011. The 2013 passenger level represents a new record high for Logan Airport. At the same time, the total number of aircraft operations fell from approximately 368,987 in 2011 to 354,869 in 2012, a decrease of 3.8 percent. In 2013, aircraft operations increased by 1.8 percent to 361,339. Despite the increase in airport operations from 2012 to 2013, aircraft operations at Logan Airport remained well below the 487,996 operations accommodated in 2000 and the historic peak of 507,449 operations reached in 1998. Passenger aircraft operations, which accounted for 91 percent of total aircraft operations, increased by 2.4 percent in 2013 after decreasing by 3.9 percent in 2012, compared to 2011 levels.

General aviation (GA) operations which is defined as aviation activity other than commercial airline activity, accounted for seven percent of total operations in 2013. GA decreased by 0.4 percent in 2012 and decreased by 5.1 percent in 2013. The 26,682 GA operations in 2013 remain below the 35,233 GA operations that Logan Airport handled in 2000.

Airline efficiency continued to increase as the average total number of passengers per aircraft operation increased from 78.3 percent in 2011 to 82.4 percent in 2012 and 83.6 percent in 2013. The average number of passengers per aircraft operation in 2012 and 2013 represented approximately 74 percent of average aircraft seat capacity. At Logan Airport, the increasing number of passengers per flight reflects a shift away from smaller aircraft and rising load factors because airlines have reduced or restricted capacity growth after several airline mergers.

Air cargo volumes, including shipments transported in the belly compartments of passenger aircraft, decreased from 562 million pounds in 2011 to 553 million pounds in 2012, a decline of 1.4 percent compared to 2011. Over the same period, all-cargo aircraft operations fell by 16.5 percent to 5,237 million pounds. All-cargo aircraft operations fell at a faster rate than cargo volumes, because all-cargo airlines introduced larger capacity aircraft into service at Logan Airport. In 2013 air cargo volumes increased by 0.8 percent to 558 million pounds and all-cargo operations increased by 3.2 percent to 5,403 million pounds, compared to 2012.

The 2014 EDR should report on airport activity levels and aircraft operations, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels; A7
- Cargo and mail activities;
- Compare 2014 aircraft operations, cargo/mail operations, and passenger activity levels to 2013 activity levels; and
- Report on national aviation trends in 2014 and compare to trends at Logan Airport.

It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives for the future ESPR. Massport should address comments related to activity levels in the 2014 EDR. A8

Sustainability at Logan Airport

The 2012-2013 EDR describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

The 2012-2013 EDR describes Massport's continued efforts including Massport-wide sustainability. In 2013, Massport was awarded a grant by the Federal Aviation Administration (FAA) to prepare a Sustainability Management Plan (SMP) for Logan Airport. The Logan

Airport SMP planning effort began in May 2013, and is expected to be completed in 2015. The 2012-2013 EDR indicates that the Logan Airport SMP is intended to promote and integrate sustainability, formulate a list of priority initiatives, and engage employees and tenants in the process. The 2012-2013 EDR provides an excellent overview of Massport's commitment to incorporate sustainability into all aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance. It also identifies specific practices to reduce impacts associated with construction and efforts to address energy intensity, percentage of renewable energy, and GHG reductions.

A specific example includes compliance with the Leading by Example Executive Order which requires state agencies to procure 15 percent of their electricity from renewable resources by 2012. The Leading by Example program has influenced Massport's own operations including its offices, heating plants, and garages resulting in Massport receiving the Leading by Example award in 2008. As part of the Leading by Example program, all new construction and major renovations over 20,000 square feet constructed by Commonwealth agencies must meet the Massachusetts LEED Plus green building standard established by the Massachusetts Sustainable Design Roundtable.

I commend Massport for its commitment and expect progress on the SMP will be incorporated into subsequent EDRs and ESPRs. The focus in the 2014 EDR should include reporting on data, identifying goals and priorities for specific Massport and tenant projects at Logan Airport that have undergone MEPA review to include energy efficiency/greenhouse gas reduction, water conservation, and waste management and recycling. A9

The 2014 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review, including whether they are under construction or completed. The status of mitigation commitments made in the Section 61 Findings for the following projects should also be reported: A10

- West Garage/Central Garage (EEA #9790)
- International Gateway (EEA #9791)
- Logan Airside Improvements Planning Project (EEA #10458)
- Terminal A Replacement Project (EEA #12096)
- Southwest Service Area Redevelopment Program/Rental Car Center (EEA #14137)
- Logan Runway Safety Area Improvements Project (EEA #14442)

Planning

The Airport Planning chapter in the 2012-2013 EDR provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2012 and 2013. It also describes future planning, construction, and permitting activities and initiatives. It includes the following Airport Projects:

- Southwest Service Area (SWSA) Redevelopment Program (EEA #14137);
- Logan Airport Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R (EEA #14442);

- Logan Airport Runway 33L Light Pier Replacement Project (EEA #14442);
- Green Bus Depot (EEA #14629);
- Martin A. Coughlin (East Boston-Chelsea) Bypass Project (EEA #14661);
- Renovations and Improvements at Terminal B;
- Terminal B Garage Improvement Project;
- North Service Area Roadway Corridor Project;
- Greenway Connector Project a pedestrian/bicycle path connecting the Bremen Street Park path to the future City of Boston pedestrian/bicycle path; and
- Hangar Upgrade Projects.

At the end of 2013, Massport initiated the Disaster and Infrastructure Resiliency Planning (DIRP) Study for Logan Airport, the Port of Boston, and Massport's waterfront assets in South and East Boston according to the 2012-2013 EDR. The DIRP Study includes a hazard analysis, modeling projected sea-level rise and storm surge, and projections of temperature and precipitation and anticipated increases in extreme weather events. The study is nearing completion. The 2014 EDR should address the DIRP Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change. A11

Massport is in the process of developing a long-term parking management plan for Logan Airport. The Long-Term Parking Management Plan will lay out a multi-part strategy for efficiently managing parking supply, pricing, and operations – both at Logan Airport and at off-Airport locations controlled by Massport – to maximize access for transit and shared-ride vehicles while minimizing both drive-and-park and pick-up/drop-off modes. The 2014 EDR should provide updates on this plan. A12

The 2014 EDR should also continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Therefore, the 2014 EDR should also describe the status of planning initiatives for the following areas: A13

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2014 EDR should provide a status report on long-range planning activities. This chapter should include the status and effectiveness of the ground access changes, including roadway and parking projects, that will consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods. A14

<u>Regional Transportation</u>

The 2012-2013 EDR describes activity levels at New England's regional airports in 2012 and 2013 and provides an update on regional planning activities, including long-range transportation efforts.

Overall, aviation activity at New England's regional airports decreased in 2012 and 2013. In 2012, the total number of air passengers utilizing New England's commercial service airports, including Logan Airport, decreased by 1.3 percent from 44.7 million in 2011 to 44.1 million annual air passengers. The decline in the region's passenger traffic largely reflects airline service reductions at many of the regional airports in 2012. Airlines have attempted to maintain tighter capacity control, which has resulted in ongoing service cuts at various secondary and tertiary airports across the nation. While passenger traffic at Logan Airport increased slightly in 2012, reduced passenger levels at regional airports resulted in an overall decline for the region. In 2013, however, overall passenger traffic at New England commercial airports recovered somewhat, increasing 2.8 percent from 44.1 million to 45.4 million passengers. Passenger traffic at New England airports in 2013 was the highest since the economic downturn in 2008. In 2013, total passenger traffic at the regional airports increased 1.6 percent from the previous year, while passenger traffic at Logan Airport increased by 3.4 percent.

The 2014 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2014 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements; and
- Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport's efforts to promote these airports. A15

Regional Transportation System

- Massport's role in managing the regional transportation facilities within the restructured Massachusetts Department of Transportation (MassDOT);
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

<u>Ground Access to and from Logan Airport</u>

The 2012-2013 EDR reports on transit ridership, roadways, traffic volumes, and parking for both 2012 and 2013. Specifically, the average daily vehicular traffic on Airport roadways decreased by 0.2 percent from 99,449 in 2011 to 99,281 in 2012, and then increased by 3.5 percent to 102,771 between 2012 and 2013. The 2012-2013 EDR also updates information on the Logan Parking Freeze limit which is set at 21,088, of which 18,415 are dedicated to commercial

parking spaces and 2,673 are dedicated to employee parking spaces. The EDR indicates that Massport continued to be in full compliance with the Parking Freeze throughout 2012 and 2013.

The 2012-2013 EDR includes key findings for ground access activity to and from the Airport which include:

- Massachusetts Bay Transportation Authority (MBTA) Silver Line bus boardings at the Airport continued to grow, based on ridership estimates.
- In 2012, Blue Line transit boardings at Airport Station increased about seven percent over 2011 levels. In 2013, MBTA Blue Line ridership increased six percent over 2012 levels.
- In 2012, ridership levels on all types of water transportation to the Airport remained flat in comparison to the previous year. Ridership on the MBTA ferry continues to decline, while private water taxi use has grown slightly since 2007. In 2013, ridership on private water taxis increased by three percent.
- In 2012, air passengers using Logan Express bus service increased 10 percent compared to 2011 levels; employee use of Logan Express increased by 16 percent and non-employee passengers increased nearly five percent. In 2013, non-employee passenger ridership increased nearly eight percent over 2012 levels, and employee passenger activity increased almost two percent.
- In September 2013, Massport solicited an operator for a Back Bay express shuttle bus service, which commenced in April 2014. The Back Bay Logan Express, provides improved service to those transit riders who are affected by the two-year Government Center MBTA Station closure and increases high occupancy vehicle (HOV) use from the inner Boston area.

The 2014 EDR should report on the following conditions and provide a discussion of analysis in 2014 and compare them to 2013:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Logan Airport Employee Transportation Management Association (Logan TMA) services; A16
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and
- Results of the 2013 Logan Airport Passenger Survey.
- Massport's target HOV mode share along with incentives; and,
- Non-Airport through-traffic;

Noise Abatement

The 2012-2013 EDR updates the status of the noise environment at Logan Airport in 2012 and 2013, and describes Massport's efforts to reduce noise levels. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The 2014 EDR should address the noise issues raised by numerous commenters on the 2012-2013 EDR

Compared to 2011, the 2012 Day-Night Average Sound Level (DNL) 65-decibel (dB) contours were slightly larger in East Boston, Revere, South Boston, and Winthrop and smaller over Boston Harbor towards Long Island and south towards Columbia Point. The 2012 contours remained substantially smaller than the 2000 contours. There are several factors that influenced the contour changes, including: Runway 15R-33L, the nighttime noise abatement runway, was temporarily closed from June 16, 2012 through October 2, 2012 to allow for the second and final period of construction of the enhanced Runway 33L RSA. There were also partial construction closures of the runway before and after this period. Typically, this runway is used during these periods for head-to-head operations (arrivals to Runway 33L and departures from Runway 15R) at night, which keeps air traffic over Boston Harbor, and away from the community. The 2012 RSA construction closure was extended for longer period than in 2011, which also extended the use of other runways for nighttime operations during 2012. During this period, night operations primarily used Runway 22R and Runway 9 for departures and Runway 4R, 27, and 22L for arrivals.

Compared to 2012, the 2013 DNL 65 dB contours were slightly larger in East Boston and slightly smaller in Revere, South Boston, and Winthrop. The 2013 contours remained substantially smaller than the 2000 contours. There are several factors that influenced the contour changes, including:

- Runway use in 2013 was reflective of a typical year (return to pre-construction conditions), with an increased use (compared to 2012) of Runway 15R-33L and Runway 27;
- The availability of all runway configurations in 2013, resulted in lower levels of arrivals to Runways 22L, 27, and 4R;
- Due to the runway closure, the overall number of people exposed to DNL values greater than 65 dB increased to 4,736 people in 2012 from 3,947 people in 2011 (an increase of 789 people); and
- In 2013 with runway use back to pre-construction patterns, the overall number of people exposed to DNL values greater than 65 dB decreased to 4,307 people in 2013 from 4,736 people in 2012 (a decrease of 429 people).

The number of people residing within the DNL 70 dB contour increased from 130 people in 2011 to 200 people in 2012 and returned to 130 people in 2013. These levels are still well below the number of people exposed in the year 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB. All of the residences exposed to levels greater than DNL 65 dB in 2012 and 2013 have been eligible to participate in Massport's residential sound insulation program (RSIP). Participation in the program is voluntary and Massport has provided sound insulation to all of homeowners who

have chosen to participate. An additional 76 residential units received sound insulation treatment in 2013 bringing the program total to 11,409 residential units. Massport will continue to seek funding for this program.

Massport is participating in a FAA aircraft noise study as part of the Airside Improvement Project mitigation. The primary focus of the Boston Logan Airport Noise Study (BLANS) is to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency. The Runway Navigation (RNAV) departure portions of Phase 1 of the project, first implemented in 2010, continued to be utilized in 2012 and 2013. The 2012-2013 EDR detailed the Flight Track Monitoring reports in Appendix of Noise Abatement.

The information in the Noise Abatement chapter is very informative and I encourage Massport to continue with detailed analysis in the 2014 EDR. I strongly advise Massport to consider and address the comments on noise and noise related issues.

The 2014 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2014 conditions and compare those conditions to those of 2013 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft; A17
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

The 2014 EDR should also report on 2014 conditions and compare those to 2013 conditions for the following noise indicators:

- Using the FAA's most current version of the Integrated Noise Model (INM), and RealContoursTM and RealProfilesTM, produce an accurate set of Day-Night Sound Level (DNL) noise contours.
- Update on FAA's combined air quality and noise modeling tool (Aviation Environmental Design Tool - AEDT)
- Noise-impacted population; A18
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContoursTM and RealProfilesTM;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The 2014 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system. A19

Air Quality/Emissions Reduction

The 2012-2013 EDR provides an overview of airport-related air quality issues in 2012 and 2013 and also efforts to reduce emissions. The air quality modeling reported in 2012-2013 EDR is based on aircraft operations, fleet mix characteristics, and airfield taxiing times combined with ground support equipment (GSE) usage, motor vehicle traffic volumes, and stationary source utilization rates. Motor vehicle emissions for the 2012 analysis were obtained from the United States Environmental Protection Agency's (EPA's) MOBILE model (MOBILE6.2.03) combined with MassDEP-recommended motor vehicle fleet mix data, operating conditions, and other Massachusetts-specific input parameters. The most up-to-date EPA mobile model, Motor Vehicle Emission Simulator (MOVES), was used to develop 2013 motor vehicle emission factors. For comparative purposes, both MOBILE and MOVES were used to generate the 2013 motor vehicle emission factors.

The following is a summary of modeled air quality conditions for Logan Airport in the 2012 to 2013 time-period:

- Total volatile organic compound (VOC) emissions in 2012 were 1,080 kilograms per day (kg/day), or approximately three percent lower than 2011 levels. By comparison, total VOC emissions in 2013 were 1,138 kg/day, or 5 percent higher than 2012 levels. For comparison, total VOC emissions were 1,777 kg/day in 2000.
- Total emissions of oxides of nitrogen (NO_x) in 2012 were 4,099 kg/day, or less than one percent higher than 2011 levels. However, total emissions of NO_x in 2013 were 4,020 kg/day, or two percent lower than 2012 levels. For comparison, total NO_x emissions were 5,707 kg/day in 2000.
- Total emissions of carbon monoxide (CO) in 2012 were 6,739 kg/day, or three percent lower than 2011 levels. However, total emissions of CO in 2013 were 7,340 kg/day, or nine percent higher than 2012 levels. For comparison, total CO emissions were 13,111 kg/day in 2000.
- Total emissions of particulate matter $(PM)_{10}/PM_{2.5}$ increased in 2012 by approximately seven percent to 72 kg/day compared to 2011 levels. This particular increase is unique and is mostly attributable to a change the MOBILE6.2.03 model. Total modeled emissions of $PM_{10}/PM_{2.5}$ again increased in 2013 by approximately 28 percent to 92 kg/day compared to 2012 levels. This increase is primarily attributable to the updated computer modeling (i.e., Emissions and Dispersion Modeling System [EDMS] and MassDEP-preferred model –MOVES) used to calculate aircraft and motor vehicle emissions.
- With respect to Massport's Air Quality Initiative (AQI) 1999 benchmark, total NO_x emissions in 2012 were 698 tons per year (tpy) lower than the benchmark and in 2013 emissions were 730 tpy lower than the benchmark. This represents an overall decrease of 31 percent in NO_x emissions since 1999. For comparison, total NO_x emissions in 2000 were 51 tpy lower than the benchmark or a decrease of 2 percent since 1999.

The year 2013 marks the seventh consecutive year in which Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the EDR/ESPR. The 2012 and 2013 GHG emission inventory was again prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). Total Logan Airport GHG emissions in 2012 were approximately three percent lower than 2011 levels primarily due to lower fuel consumption by stationary sources. Total Logan Airport GHG emissions in 2013 were approximately six percent higher than 2012 levels primarily due to the increase in usage of passenger ground access vehicles on off-airport roadways. In 2012, Massport-related emissions represented 10 percent of total GHG emissions at the Airport; tenant-based emissions represented approximately 69 percent; electrical consumption represented 14 percent; and passenger vehicle emissions represented six percent. Similarly, in 2013, Massport-related emissions represented 13 percent of total GHG emissions at the Airport, tenant-based emissions represented approximately 66 percent, electrical consumption represented 10 percent, and passenger vehicle emissions represented 10 percent.

The 2014 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The 2014 EDR should provide discussion on progress on the national and international levels to decrease air emissions. It should also include analysis methodologies and assumptions and report on 2014 conditions using the most recent versions of the EDMS and MOVES models. The 2014 EDR should include an emissions inventory for CO, NO_x, VOCs, and PM. It should include NO_2 monitoring and identify NO_x emissions by airline. A20

The 2014 EDR should also report on the following AQI for 2014:

- AQI Emissions Monitoring and Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and A21
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

Massport has also committed to include an inventory of GHG emissions from Logan Airport in 2014. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the MEPA Greenhouse Gas Emissions Policy and Protocol. The results of the 2014 GHG emissions inventory should be compared to the 2013 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. A22

<u>Water Quality/Environmental Compliance</u>

The 2012-2013 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management.

The 2014 EDR should report on the 2014 status of:

- NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- MCP activities; A23
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

It should also identify any planned stormwater management improvements.

Conclusion

I have determined that the 2012-2013 EDR for Logan Airport has adequately compiled with MEPA. Massport may prepare a 2014 EDR for submission in 2015 consistent with the scope included in this Certificate.

February 6, 2015
Date

Matthew A. Beaton

Comments received:

01/14/2015	Frank J. Ciano
01/26/2015	Cindy L. Christiansen
01/26/2015	City of Somerville, Mayor Joseph Curtatone
01/27/2015	The Boston Harbor Association
01/27/2015	Nancy S. Timmerman
02/02/2015	Massachusetts Department of Public Health

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Comment #	Author	Topic	Comment	Response
A.1	Matthew A. Beaton, Secretary	General	The *2014 EDR* should follow the general format of the *2012/2013 EDR* status report. The *2014 EDR* should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide background information on the environmental policies and planning that form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport to provide context for reviewing agencies and the public.	The *2014 Logan Airport EDR* will follow the format specified.
A.2	Matthew A. Beaton, Secretary	General	The *2014 EDR* should provide an update on conditions at Logan Airport for calendar year 2014, including passenger and aircraft operation activity levels. It should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate. It should provide a status report on Massport's proposed planning initiatives, projects, and mitigation measures.	The *2014 Logan Airport EDR* includes the specified sections as follows: Chapter 2, *Activity Levels;* Chapter 3, *Airport Planning* ; Chapter 9, *Project Mitigation Tracking.*
A.3	Matthew A. Beaton, Secretary	General	The technical studies in the *2014 EDR* should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The *2014 EDR* must also respond to those issues explicitly noted in this Certificate and the comments received on the *2012/2013 EDR* .	The *2014 Logan Airport EDR* includes the specified sections as follows: Chapter 4, *Regional Transportation* ; Chapter 5, *Ground Access to and from Logan Airport* ; Chapter 6, *Noise Abatement* ; Chapter 7, *Air Quality/Emissions Reduction* ; Chapter 8, *Water Quality/Environmental Compliance* .
A.4	Matthew A. Beaton, Secretary	General	A distribution list for the *2014 EDR* (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the *2004 ESPR* (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.	The *2014 EDR* includes the specified sections as follows: Appendix D, *Distribution List* , Appendix A, *MEPA Certificates and Responses to Comments* .
A.5	Matthew A. Beaton, Secretary	Response to Comments	The *2014 EDR* Responses to Comments section should address all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments chapter included in the *2012/2013 EDR* is well-constructed and cross-referenced. I encourage Massport to use the same format in the *2014 EDR* .	The *2014 EDR* includes the specified sections as follows: Appendix B, *Comment Letters and Responses.*

Comment #	Author	Topic	Comment	Response
A.6	Matthew A. Beaton, Secretary	Response to Comments	The majority of comments received on the *2012/2013 EDR* focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the *2014 EDR* should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.	Chapter 6, *Noise Abatement*, includes information on noise tracking and abatement.
A.7	Matthew A. Beaton, Secretary	Activity Levels	The *2014 EDR* should report on airport activity levels and aircraft operations, including: • Aircraft operations, including fleet mix and scheduled airline services at Logan Airport; • Passenger activity levels; • Cargo and mail activities; • Compare 2014 aircraft operations, cargo/mail operations, and passenger activity levels to 2013 activity levels; and • Report on national aviation trends in 2014 and compare to trends at Logan Airport.	The *2014 EDR* includes the specified sections in Chapter 2, *Activity Levels*.
A.8	Matthew A. Beaton, Secretary	Activity Levels	It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives for the future ESPR. Massport should address comments related to activity levels in the *2014 EDR*.	The *2014 EDR* includes the specified sections in Chapter 2, *Activity Levels*.
A.9	Matthew A. Beaton, Secretary	Sustainability	The focus in the *2014 EDR* should include reporting on data, identifying goals and priorities for specific Massport and tenant projects at Logan Airport that have undergone MEPA review to include energy efficiency/greenhouse gas reduction, water conservation, and waste management and recycling.	The *2014 EDR* includes an updated section on sustainability initiatives at Logan Airport in Chapter 1, *Introduction/Executive Summary.* This EDR also references the Logan Airport Sustainability Management Plan, which was released April 2015 and is available on Massport's website (https://www.massport.com/media/320786/LoganSMP_Report.pdf). Massport plans to report on sustainabiilty initiatives, including energy efficiency, greenhouse gas reduction, water conservation, and waste management/recycling in annual sustainability reports, which will be referenced in the EDR and available online.

Comment #	Author	Topic	Comment	Response
A.10	Matthew A. Beaton, Secretary	Sustainability	The *2014 EDR* should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review, including whether they are under construction or completed. The status of mitigation commitments made in the Section 61 Findings for the following projects should also be reported: • West Garage/Central Garage (EEA #9790) • International Gateway (EEA #9791) • Logan Airside Improvements Planning Project (EEA #10458) • Terminal A Replacement Project (EEA #12096) • Southwest Service Area Redevelopment Program/Rental Car Center (EEA # 14137) • Logan Runway Safety Area Improvements Project (EEA # 14442)	The *2014 EDR* includes the specified sections in Chapter 9, *Project Mitigation Tracking.*
A.11	Matthew A. Beaton, Secretary	Planning	The *2014 EDR* should address the DIRP Study and identify which recommendations Massport will implement in the short term to increase the resiliency of its facilities to the potential effects of climate change.	DIRP Study findings are reported on in Chapter 1, *Introduction/Executive Summary* and Chapter 3, *Airport Planning.*
A.12	Matthew A. Beaton, Secretary	Planning	Massport is in the process of developing a long-term parking management plan for Logan Airport. The Long-Term Parking Management Plan will lay out a multi-part strategy for efficiently managing parking supply, pricing, and operations -both at Logan Airport and at off- Airport locations controlled by Massport -to maximize access for transit and shared-ride vehicles while minimizing both drive-and-park and pick-up/drop-off modes. The *2014 EDR* should provide updates on this plan.	The *2014 EDR* includes the specified sections in Chapter 3, *Airport Planning* .

Comment #	Author	Topic	Comment	Response
A.13	Matthew A. Beaton, Secretary	Planning	The *2014 EDR* should also continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Therefore, the *2014 EDR* should also describe the status of planning initiatives for the following areas: • Roadway Corridor Project; • Airport Parking; • Terminal Area; • Airside Area; • Service and Cargo Areas; and • Airport Buffers and Landscaping.	The *2014 EDR* includes the specified sections in Chapter 3, *Airport Planning*.
A.14	Matthew A. Beaton, Secretary	Planning	The *2014 EDR* should provide a status report on long-range planning activities. This chapter should include the status and effectiveness of the ground access changes, including roadway and parking projects, that will consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.	The *2014 EDR* includes the specified sections in Chapter 5, *Ground Access to and from Logan Airport*.

Comment #	Author	Topic	Comment	Response
A.15	Matthew A. Beaton, Secretary	Regional Transportation	The *2014 EDR* should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following: Regional Airports • 2014 regional airport operations, passenger activity levels, and schedule data within an historical context; • Status of plans and new improvements as provided by the regional airport authorities; • Ground access improvements; and • Role of the Worcester Regional Airport and Hanscom Field in the regional aviation system and Massport' s efforts to promote these airports. Regional Transportation System • Massport's role in managing the regional transportation facilities within the restructured Massachusetts Department of Transportation (MassDOT); • Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and • Report on metropolitan and regional rail initiatives and ridership.	The *2014 EDR* includes the specified sections in Chapter 4, *Regional Transportation* .

Comment #	Author	Topic	Comment	Response
A.16	Matthew A. Beaton, Secretary	Ground Access	The *2014 EDR* should report on the following conditions and provide a discussion of analysis in 2014 and compare them to 2013: • Detailed description of compliance with Logan Airport Parking Freeze; • High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express); • Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line; • Logan Airport Employee Transportation Management Association (Logan AIrport TMA) services; • Logan Airport gateway volumes; • On-airport traffic volumes; • On-airport vehicle miles traveled (VMT); • Parking demand and management (including rates and duration statistics); • Status of long-range ground access management strategy planning; and • Results of the 2013 Logan Airport Passenger Survey. • Massport's target HOV mode share along with incentives; and, • Non-Airport through-traffic.	The *2014 EDR* includes the specified sections in Chapter 5, *Ground Access to and from Logan Airport* .
A.17	Matthew A. Beaton, Secretary	Noise	The *2014 EDR* should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2014 conditions and compare those conditions to those of 2013 for the following: • Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage Ill, and qualifying Stage IV aircraft; • Nighttime operations; • Runway utilization (report on aircraft and airline adherence with runway utilization goals); • Preferential runway advisory system (PRAS) tracking; and • Flight tracks.	The *2014 EDR* includes the specified sections in Chapter 6, *Noise Abatement* .

Comment #	Author	Topic	Comment	Response
A.18	Matthew A. Beaton, Secretary	Noise	The *2014 EDR* should also report on 2014 conditions and compare those to 2013 conditions for the following noise indicators: • Using the FAA's most current version of the Integrated Noise Model (INM), and RealContoursTM and RealProfilesTM, produce an accurate set of Day-Night Sound Level (DNL) noise contours. • Update on FAA's combined air quality and noise modeling tool (Aviation Environmental Design Tool - AEDT) • Noise-impacted population; • Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContoursTM and RealProfilesTM; • Cumulative Noise Index (CNI); • Times-Above for 65_, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels; • Installation and benefits of the new noise monitoring system; and • Flight track monitoring noise quarterly reports.	The *2014 EDR* includes the specified sections in Chapter 6, *Noise Abatement* .
A.19	Matthew A. Beaton, Secretary	Noise	The *2014 EDR* should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system.	The *2014 EDR* includes the specified sections in Chapter 6, *Noise Abatement* , and associated Appendix H, *Noise Abatement*
A.20	Matthew A. Beaton, Secretary	Air Quality / Emissions Reduction	The *2014 EDR* should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The *2014 EDR* should provide discussion on progress on the national and international levels to decrease air emissions. It should also include analysis methodologies and assumptions and report on 2014 conditions using the most recent versions of the EDMS and MOVES models. The *2014 EDR* should include an emissions inventory for CO, NOx, VOCs, and PM. It should include N02 monitoring and identify NOx emissions by airline.	The *2014 EDR* includes the specified sections in Chapter 7, *Air Quality* .

Comment #	Author	Topic	Comment	Response
A.21	Matthew A. Beaton, Secretary	Air Quality / Emissions Reduction	The *2014 EDR* should also report on the following AQI for 2014: • AQI Emissions Monitoring and Tracking; • Massport's and Tenant's Alternative Fuel Vehicle Programs; and • The status of Logan Airport air quality studies undertaken by Massport or others, as available.	The *2014 EDR* includes the specified sections in Chapter 7, *Air Quality*.
A.22	Matthew A. Beaton, Secretary	Air Quality / Emissions Reduction	Massport has also committed to include an inventory of GHG emissions from Logan Airport in 2014. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the MEPA Greenhouse Gas Emissions Policy and Protocol. The results of the 2014 GHG emissions inventory should be compared to the 2013 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions.	The *2014 EDR* includes the specified sections in Chapter 7, *Air Quality*.
A.23	Matthew A. Beaton, Secretary	Water Quality	The *2014 EDR* should report on the 2014 status of: • NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility; • Jet fuel usage and spills; • MCP activities; • Tank management; • Update on the environmental management plan; and • Fuel spill prevention. It should also identify any planned storm water management improvements.	The *2014 EDR* includes the specified sections in Chapter 8, *Water Quality*.

Copies of Secretary of the Executive Office of Energy and Environmental Affairs Certificates issued for the Reporting Years 2004, 2005, 2006, 2007, 2008, 2009, 2010, and 2011.

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August 16, 2006

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE ENVIRONMENTAL STATUS AND PLANNING REPORT

PROJECT NAME	: 2004 Logan Environmental Status and Planning Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: June 7, 2006

As Secretary of Environmental Affairs, I hereby determine that the Environmental Status and Planning Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massachusetts Port Authority's (Massport) long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a five-year basis, with much less detailed Environmental Data Reports filed in the years between submission of the ESPRs. The 2004 ESPR is the subject of this Certificate.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs (EOEA) issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions

where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

This 2004 ESPR was originally scheduled to be completed in 2005, but was postponed until 2006. The 2004 ESPR was delayed because of delays associated with the completion of the New England Regional Aviation System Plan (NERASP). Massport adopted the NERASP forecasts for its 2020 Logan Airport forecast of aviation activity in this ESPR, and upon which the analysis of 2020 environmental conditions is based. Postponing completion of the 2004 ESPR ensured that the forecasts used in the ESPR are the most current and accurate forecasts available.

Review of the 2004 ESPR

In general, the ESPR has responded to the scope. In particular, the ESPR contains a wealth of useful data on activity levels and impacts, and lays out a forecast for trends in the future years. The technical studies in the 2004 ESPR included reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking.

As always, EOEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." This Certificate on the ESPR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2005 EDR should detail how Massport is meeting this commitment. The 2005 EDR must also address all of the air quality issues raised by the commenters.

Although Massport has presented a detailed ESPR, I remain concerned with a number of environmental issues, specifically air quality and noise related issues, as outlined below.

Follow-up

Massport should submit the next EDR (analyzing conditions for the 2005 calendar year no later than December 15, 2006. I recognize that this Certificate requires the inclusion of considerable follow-up in that document. However, ESPRs invariably raise important issues which require follow-up sooner rather than later, and this ESPR is no exception. I anticipate that the EDR in a year following the publication of an ESPR will always have to include such analytical follow-up to the ESPR and respond to comments on the ESPR. Other EDRs should provide more of a

"snapshot" of the previous year's operations and impacts, with more substantial analysis awaiting the next GEIR. EDRs in years other than the year immediately following publication of an ESPR should therefore be considerably less voluminous and Massport should strive to submit these documents by July 31 of the year following the subject year.

Responses to Comments

The next EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this ESPR is well-constructed and cross-referenced (although several comments have complained of general responses or document references in response to specific questions). Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2005 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts.

Airport Activity Levels

The ESPR included a chapter on airport activity levels, including information on aircraft operations, fleet mix, passenger activity levels, and cargo and mail operations. This chapter also reported on Massport's forecasts that will become the basis for Massport's strategic planning initiatives over the next few years. Past forecasts were based on low, medium, and high passenger activity levels. New forecasts are now based on the forecasts for 2020 developed for the New England Regional Airport System Plan (NERASP) study. This chapter included aircraft operations and passenger activity forecasts, and provided a discussion of methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry.

Air passenger traffic at Logan Airport continued to rebound in 2004, but remained below the peak year level reached in 2000. The total number of passengers using Logan Airport in 2004 increased by 14.7 percent over 2003 levels to 26.1 million passengers. Although the recovery in passenger demand was underway in 2004 at Logan Airport and throughout the industry, legacy commercial airlines continued to struggle financially as competition from low cost carrier (LCC) rivals increased and fuel prices remained high.

For the first time since 1998, total annual aircraft operations (arrivals and departures) at Logan Airport increased compared to the previous year and were at their highest level since 2001. Daily operations in 2004 averaged approximately 1,107 compared to approximately 1,027 in 2003, an increase of about 80 operations per day or about 8.6 percent. 2004 levels remain below historic peaks. The growth in aircraft activity was driven primarily by the entry and expansion of LCCs at Logan Airport in 2004. This increase in LCC services in 2004 stimulated growth in airport

passenger demand.

In 2004, Logan Airport ranked 19th among US airports in total cargo volume. All-cargo operations at Logan Airport declined by less than 1 percent in 2004. However, total cargo volume, including cargo carried in the belly compartments of passenger aircraft, rose by 0.6 percent.

Airport Planning

This section described the status of planning initiatives and projects through the planning horizon year (2020) for the Terminal Area; Airside Area; Service and Cargo Areas; and Edge Buffers and Landscaping. The Airport Planning Chapter also reported on the status of public works projects implemented by other agencies within the boundaries of Logan Airport.

Several projects were completed in 2004:

- The majority of construction of the main terminal and satellite concourse of Delta Air Lines' Replacement Terminal A Project was completed in 2004.
- A dedicated hourly parking area opened on the lower level of the Terminal B Garage in July 2004.
- Massport also launched Exit Express, Massport's convenient way to pay for parking.
- The Massachusetts Bay Transportation Authority's (MBTA's) $23 million new Blue Line Airport Station opened in June 2004.
- Demolition of the old MBTA Airport Station was completed in 2004.
- By the end of 2004, completion of the Central Artery/Tunnel (CA/T) Project and improvements to the roadway system were complete, allowing for a more efficient roadway network with shorter and more direct routes between destinations in the airport and the regional highway system.
- The Silver Line, the most recent addition to the transit system and Boston's first Bus Rapid Transit line, began limited service to Logan Airport in December 2004.

Both Massport and Logan Airport's tenants are proposing projects or exploring planning options to modernize and carry out future improvements at Logan Airport. Massport's planning criteria for Logan Modernization are based on accommodating 45 million annual passengers in airport terminals, facilities, and on airport roadways. Future projects and planning concepts include:

- Both Massport and Logan Airport's tenants are proposing projects or exploring planning options to modernize and carry out future improvements to the existing terminal facilities. Some projects and planning concepts include ongoing expansion and upgrade of Terminal E and constructing a new satellite Federal Inspectional Services (FIS) Facility at the southeast end of Terminal B.
- Some projects and planning concepts that are underway or under consideration include, consolidating flight kitchen facilities in the north service area, constructing new multi tenant maintenance facilities for ground service equipment (GSE), and constructing new

hangar facilities in the north cargo area.

- Airside improvements include upgrades and improvements to the airfield to enhance the operations efficiency and safety of Logan Airport. Some projects and planning concepts that are underway or under consideration include, installing a security wall along the perimeter of the air operations area, providing additional aircraft parking for certain types of aircraft, and an airside improvements planning project to reduce current and projected levels of aircraft delay.
- Buffer areas are being designed in consultation with Logan Airport's neighbors and other interested parties in an open community planning process. Some future airport buffer projects and planning concepts include, landscaping the former Navy Fuel Pier at Jefferies Point, installing a landscaped border in conjunction with the north service area Economy Parking Lot construction, and constructing a half-acre linear area with landscaping and lighting improvements along Maverick Street.
- Massport is considering a parking strategy to address future on-airport parking demands. Some ongoing and future parking projects and planning concepts include redeveloping three parcels into a combined economy parking facility with the capacity for up to 1,750 vehicles, proposed parking facility in the Southwest Service Area, and a new consolidated facility for all car rental operations

Regional Transportation Context

Overall, aviation activity levels at New England's regional airports increased in 2004, as passenger demand continued to rebound both within the region and nationally after the 2001 downturn. Just as the passenger decline seen at the regional airports in the wake of September 11, 2001 was less severe than the declines experienced at Logan Airport, the traffic recovery seen at the regional airports in 2004 was not as strong as the rebound experienced at Logan Airport. Growth at Logan Airport was largely fueled by a growing presence of LCC services.
At the same time, regional airports continued to experience growth in 2004 and served a significant (42.5 percent) share of the region's air passenger traffic. Several factors have contributed to the success of the regional airports in recent years:

- Many of the regional airports benefited from the introduction and growth of LCC services over the past several years. This trend began when Southwest Airlines entered the New England market in 1996 by serving T.F. Green Airport in Warwick, Rhode Island and later expanding into the Manchester and Hartford/Bradley International Airports. The trend continued in 2004 when Spirit Airlines began service from T.F. Green Airport, Independence Air5 initiated low-fare service at several of the regional airports, and Southwest Airlines continued to increase service from its New England airports.
- Several of the smaller airports, particularly Burlington, Bangor, and Tweed-New Haven continued to benefit from the introduction of regional jets and gained new non-stop services to airline connecting hubs, which increase service options for regional airport passengers.

Ground Transportation

The chapter reported on 2004 conditions and provided a comparison of 2004 findings to previous years for variety of ground transportation indicators. The chapter also presented a discussion of analysis methodologies and assumptions for future year conditions for the planning horizon year 2020 for Traffic volumes, On-airport Vehicle miles traveled (VMT) and Parking demand.

- Completion of the CA/T and Logan Airport Modernization projects created a more efficient roadway network with shorter and more direct routes to destinations within Logan Airport.
- With the exception of water transportation, all scheduled and unscheduled high occupancy vehicle (HOV) transportation to Logan Airport saw increased ridership in 2004.
- Overall HOV mode share for air passengers increased from 25.8 percent in 1990 to 32 percent in 2003. Although the data shows a slight decrease to 30.3 percent in HOV modes in 2004, the 2003 HOV mode share was an all-time high, reflecting Massport's success in generally maintaining or increasing the percentage of passengers using HOV modes in all market segments.
- The most recent employee survey showed an employee HOV mode share of 26.8 percent.
- Airport-related average annual daily traffic (ADDT) volumes increased by 12.6 percent in 2004 over 2003 volumes. Despite this increase in ADDT volumes, the vehicle miles traveled (VMT) on Logan Airport's roadway system only increased by 3.5 percent in 2004 compared with the 2003 VMT. This reflects the effects of the changes in the airport roadway system resulting from the CA/T and Logan Airport Modernization projects, which result in a shorter average trip length, creating a much smaller increase in total VMT than in average weekday daily traffic volumes.
- Massport executed a Memorandum of Understanding with the MBTA to commence Silver Line bus rapid transit service in late 2004. Massport's support of the Silver Line Airport service will total more than $30 million over ten years.

Between 2003 and 2004, membership in the Transportation Management Association (TMA) declined by 800 employees, a 13.3% reduction. Massport stated in the ESPR that significant TMA funds had been expended for administrative functions resulting in underfunded programming. The Executive Office of Transportation's MassRIDES program will now provide a TMA coordinator at state expense. The EOT identified its expectation that Massport will "maintain its current level of effort, including both cash contributions and in-kind services.

The Secretary's June 15, 2001 Certificate on the AIPP directs Massport to require that all Logan employers join the TMA at the earliest possible opportunity. This mitigation measure is not listed in Table 10-7 and no plan is presented for meeting this requirement. A plan should be detailed in the 2005 EDR.

The ESPR indicated that two FAA programs had relocated to New Hampshire in 2004 and that Beacon-Skanska, having completed the construction of Terminal A, was no longer at Logan. Four additional corporate members left the TMA in 2004. The 2005 EDR should provide explanation for this.

The 2003 EDR stated that TMA shuttle ridership declined by 32.4 percent due to the elimination of services at mid-year due to lack of funding., but that the decrease in shuttle ridership had been more than off-set by increased Logan Express use. Massport should identify any efforts such as more active marketing of car/ridesharing options targeted to those who previously used the cancelled shuttles. This information should be provided in the 2005 EDR.

Noise

This chapter began with an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, the methodologies used to track noise, and what if any changes there was in noise modeling. The information in this chapter built upon the findings of the Boston Logan Overflight Noise Study. This chapter also updates the status Massport's efforts to reduce noise levels and provides noise contours population counts for 2020.

- Massport has continued to make improvements in the noise modeling process as the sophistication of noise models and data acquisition systems has advanced. Recent developments in noise modeling technologies and techniques employed in this 2004 ESPR and to be used in future years include: use of a new radar data acquisition system, known as a long-range PASSUR, for the source of all radar-based operations data; a new upgrade to Massport's radar data processing software; use of the latest update to the FAA's Integrated Noise Model, while retaining the unique capability to account for over-water sound propagation and hill effects unique to Logan Airport; incorporation of more than 1,800 modeled flight tracks, checked and updated where necessary to reflect 2004 radar data; use of radar data to determine the "best-fit" match among each of the nearly 402,000 radar traces captured by Logan Airport's noise monitoring system and the available climb profile contained within the INM database; procurement of an improved noise and operations monitoring system; procurement of automated altitude profile and noise contour generation software.
- From May to August 2004, Runway 4L-22R was closed either completely or partially to accommodate repaving. Due to this closure, jet aircraft departures on Runway 22R decreased by approximately 23 percent compared to 20036 while departures on other runways increased.
- As a result of changes in airport operations in 2004, the number of people exposed to Day-Night Sound Level (DNL) values greater than 65 dB increased compared to the number in 2003. An estimated 10,720 people were exposed to DNL levels greater than 65 dB in 2004, compared to 7,183 in 2003, and 8,309 in 2002. The majority of the increase occurred in East Boston off the northwest end of Runway 33L. The increases within the

65dB are in areas that were previously sound insulated. Despite these increases, the total count of people exposed to 65 dB DNL and above was 23 percent lower than in 2001.

- The 2004 Cumulative Noise Index (CNI) of 153.4 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. Although CNI also increased compared to 2003 and 2002 as a result of the increased number of operations, the 2004 level remained below the 2001 CNI value.

- The number of residential dwelling units for which Massport provided sound insulation in 2004 was 791. Since the program's inception, the total number of dwelling units receiving sound insulation is now 8,615. In addition, Massport completed sound insulation of a 36th school – the new Center School located in Winthrop.

The Logan Airport Noise Study is now expected to be conducted in at least three phases. I strongly encourage Massport to include a phase for the monitoring and assessment of altered flight paths so that any necessary modifications can be identified and implemented.

In addition, the ESPR indicated that there will be an increase from 2004 to 2020 in the number of Boston residents who will experience noise in the 70-75 DNL and the 75-80 DNL due to the use of parallel runways. Massport strive to identify ways to ensure that these increases do not occur. The 2005 EDR should include a preliminary discussion about how Massport will address projected exceedances.

Air Quality

This chapter presented an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. It also predicts emission levels for 2020.

- To ensure consistency and comparability between 1999 and 2004 air quality emissions, the 1999 air emissions inventory was updated with information that was not available when first reported and 1999 emissions were recalculated using the new version of the FAA's Emissions and Dispersion Modeling System (EDMS) v4.21. Additional data were also added to the 2004 inventory in order to increase the accuracy of the results, for example curbside queue times were updated and new parking areas were added to the inventory.

- In 2004, the emission inventory results were driven by an 8 percent increase in aircraft operations compared to 2003 activity levels. Increases in stationary source (fuel storage facilities, heating plant, etc.) emissions further contributed to the increase in levels of volatile organic compounds (VOCs) and oxides of nitrogen (NOx).
- In 2004, total VOC emissions at Logan Airport were estimated to be approximately 1,360

kilograms (kg)/day, which is an increase of 17 percent from 2003 levels. However, total VOC emissions at Logan Airport were 41 percent lower in 2004 than in 1999. The increase of VOC emissions between 2003 and 2004 was due to the increase in aircraft operations in 2004.

- In 2004, total NOx emissions from all airport-related sources were estimated to be 4,290 kg/day, which is an increase of 16 percent from 2003 levels, but is a 26 percent decrease as compared to 1999 levels. Once again, the increase in aircraft operations contributed the most to this increase in airport-related NOx in 2004.

- Total carbon monoxide (CO) emissions at Logan Airport in 2004 were estimated to be 9,852 kg/day, or 3 percent below 2003 levels. In 2004, total CO emissions at Logan Airport were 32 percent lower than 1999 levels. While CO emissions from aircraft increased due to increased aircraft operations, the use of alternative fuel vehicles (AFVs) and the lower emission rates of the motor vehicle fleet helped to reduce the overall CO emissions in 2004. Massport added three new AFVs to its fleet in 2004.

- Massport developed an Air Quality Initiative (AQI) in 2001 as a long-range program with the overall goal to maintain NOx emissions associated with Logan Airport at or below the 1999 level of 2,347 tpy. In 2004, NOx emissions from all airport-related sources were estimated to be 1,726 tpy, well below the 1999 level.

Through the June 15, 2001 Certificate of the Secretary of EOEA on the FEIR for the AIPP, Massport was directed to develop a program to maximize the use of single-engine taxiing procedures by all of its tenant airlines. Massport must describe in the 2005 EDR how it presently encourages reduced-engine (single-engine) taxiing. The cited issues of safety and practicality should be discussed and the program that will be implemented as noted in Table 10-7of the 2005 ESPR should be outlined.

Massport was also directed in the same Certificate to conduct follow-up air quality monitoring in neighborhoods surrounding the airport and surrounding flight paths. This mitigation measure does not appear in Table 10-7, "Logan Airside Improvements Planning Project, Details of Ongoing Section 61 Mitigation Measures." The 2005 EDR should address this measure in detail.

Table 7-13 of the 2004 ESPR , "Inventory of Tracking of NOx Emissions in tons per year for Logan Airport," contains numbers that have been "adjusted to reflect know reductions achieved by Massport and its tenants at Logan Airport." The 2005 EDR should include unadjusted numbers and detailed information about the means for achieving reductions and the emissions value of each reduction method.

Massport had agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI) in the June 2001 Certificate for the AIPP. The Certificate indicated that Massport was "to solicit

project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." There is no information in the ESPR about the substance and status of any process with EOEA or about the solicitation of information and objective, neutral, scientific review. The 2005 EDR should address this matter in detail.

Environmental Management/Water Quality/Environmental Compliance

This chapter reported on the activities of Massport's Environmental Management Unit in meeting the state's environmental regulatory requirements.

- In 2004, of the 126 spills reported to the Logan Airport Fire-Rescue Department, 18 spills (14 percent) were ten gallons or greater in quantity. Jet fuel spills accounted for 82 (65 percent) of the total spills, with 12 spills (15 percent) being ten gallons or greater in quantity. The remaining 44 spills involved gasoline, hydraulic oil, diesel fuel, ethylene glycol, propylene glycol, paint, and AVGAS. Of these spills, 6 (14 percent) were ten gallons or greater. Since 2002 there has been a reduction in the total volume of all spills.

- In accordance with the Massachusetts Contingency Plan (MCP), Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Massport indicates that it has had limited success in identifying the causes of exceedances due to "first flush" pollutants in stormwater, the number of potential sources at Logan, and the size of drainage areas serving outfalls. Massport needs to develop a plan for maximizing its ability to identify causes. This plan should be identified in the 2005 EDR. Massport should also include in the 2005 EDR copies of any new NPDES stormwater and fire training permits.

Sustainability Initiatives

This Chapter presented Massport's on-going and upcoming sustainability initiatives at Logan Airport. Massport continues to demonstrate forward thinking in sustainability policies and practices for transportation agencies. I encourage Massport to require tenant participation and compliance with all elements of the plan as leases are renewed.

As I stated at the beginning of this Certificate, the 2005 EDR must provide responses to the issues raised in comments received. The 2005 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2004 ESPR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, and noise abatement. Massport should consult directly with individual commentors where necessary.

A distribution list for the 2005 EDR (indicating those receiving documents, CDs, or Notices of

Availability) should be provided in the document. This section must also include copies of all GEIR/Annual Update Certificates issued since 1995 to provide context for reviewers. Supporting technical appendices should be provided as necessary.

August 16, 2006
Date

Robert W. Golledge, Jr.

Comments received:

07/25/06	Stephen Kaiser
08/08/06	Nancy Timmerman
08/09/06	MA Executive Office of Health and Human Services
08/09/06	John Vitagliano
08/09/06	Bruce Egan, Egan Environmental
08/10/06	City of Boston Environment Department
08/14/06	Boston Transportation Department

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February 15, 2007

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2005 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2005 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: December 23, 2006

As Secretary of Environmental Affairs, I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massachusetts Port Authority's (Massport) long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a five-year basis, with much less detailed Environmental Data Reports (EDR) filed in the years between submission of the ESPRs. The 2005 EDR is the subject of this Certificate.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs (EOEA) issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2005 EDR

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2005 passenger and impact levels at Logan Airport. Most environmental parameters showed significant improvement in calendar year 2005. In particular, the technical studies in the 2005 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking.

As always, EOEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EOEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2005 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2005 EDR details how Massport is meeting this commitment. The 2006 EDR should continue to report on the details of Massport's committment. In addition to the environmental issues listed below, the 2006 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2005 EDR.

Follow-up

Massport should file the next EDR (covering operations for the 2006 calendar year) in calendar year 2007. The EDR should provide more of a "snapshot" of the 2006 operations and impacts, with more substantial analysis awaiting the next GEIR. Massport should also address the comments received on the current EDR when developing its 2006 EDR.

Responses to Comments

The next EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments

included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2005 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2006 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts.

Activity Levels

The Activity Levels chapter presents aviation activity statistics for Logan Airport in 2005 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. Air passenger traffic at Logan Airport continued to rebound in 2005, but remained below the peak year level reached in 2000. Specifically, the total number of passengers using Logan Airport in 2005 increased by 3.6 percent over the prior year to 27.1 million passengers. In 2005, total aircraft operations (409,066 operations) at Logan Airport increased by 0.9 percent over 2004 levels. While 2005 passenger traffic at Logan Airport was approximately equal to 1999 levels, in 2005 these passengers were being carried on approximately 86,000 fewer flights (495,000 flights in 1999 versus 409,066 flights in 2005). Several commenters raised concerns with the increase in passenger levels requesting long-term solutions to meeting demand which do not include expansion of Logan Airport's capacity or footprint. I advise Massport to consider and attempt to address these comments in the next 20006 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2005. It also describes known future planning, construction, and permitting activities. Specifically, several projects were completed in 2005 including the majority of construction of the main terminal and satellite concourse of Delta Air Lines' Replacement. Terminal A Project was completed in 2004, with final fit up and commissioning in 2005. Massport also launched Exit Express as part of an on-going program to improve parking facilities and improve air quality through enhanced circulation and reduced idling at the toll booths. In addition, as part of a cooperative venture between the Massachusetts Bay Transportation Authority (MBTA) and Massport, initial Silver Line service to the airport began in December 2004. Full Silver Line service to Logan Airport began on June 1, 2005.

The chapter also includes future planning including: ongoing expansion and upgrade of Terminal E and completion of West Garage Phase II(Central Garage Expansion); more efficient ways of using the limited land resources in the service areas; airside improvements include upgrades and improvements to the airfield to enhance the operations, efficiency and safety of Logan Airport; In addition, buffer areas are being designed in consultation with Logan Airport's neighbors and other interested parties in a community planning process. Massport is also considering a parking strategy to address future on-airport parking demands. Some ongoing and future parking projects and planning concepts include redeveloping three parcels into a combined economy parking

facility with the capacity for up to 1,750 vehicles and a new consolidated facility for all car rental operations.

Regional Transportation

This chapter describes activity levels at New England's regional airports in 2005 and updates recent planning activities. Overall, the number of air passengers utilizing New England's primary commercial service airports in 2005 rose by 5.3 percent over 2004. When measured by aircraft operations, however, activity levels fell by 0.6 percent. This reflects sweeping changes in both the commercial aviation and general aviation (GA) sectors of the industry. Passenger numbers rose despite capacity reductions as airlines operated at higher load factors. Carriers flew fewer flights to the regional airports than in 2004, but used larger aircraft on average in 2005, and carried more passengers. GA operations at New England airports declined by 3.8 percent from the 2004 levels. The Boston Transportation Department has raised a number of suggestions related to the Regional Transportation that Massport should consider in the 2006 EDR.

Ground Transportation

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2005. Specifically, ground transportation activity levels increased from 2004 to 2005 as a result of a 3.6 percent increase in the number of air passengers. In addition, traffic volumes on airport roadways increased by 5.8 percent, while the vehicle miles traveled (VMT) on the airport increased by 4.2 percent. The lower VMT growth when compared to overall traffic volume growth suggests that more direct connections over shorter roadway distances are provided. The facilities at the MBTA Blue Line Airport Station were also substantially improved in 2005, including the conversion from a manual to an automated fare collection system. In addition, full MBTA Silver Line service to Logan Airport began on June 1, 2005. In 2005, Terminal A and its associated access roadways were fully opened for operation. There were no other roadway modifications completed in 2005. In addition, contract negotiations began between Massport and the C & J Bus Company in New Hampshire to expand early morning transportation between New Hampshire and Logan Airport. This service began in 2006. Massport also re-bid its Logan Airport Transportation Management Association (Logan TMA) contract with the Executive Office of Transportation (EOT) through the MassRIDES program.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2005, and describes Massport's efforts to reduce noise levels. In 2005, the number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) decreased compared to 2004. An estimated 6,477 people were exposed to DNL levels greater than 65 dB in 2005, compared to 9,438 in 2004, and 7,183 in 2003. The total count of people exposed to 65 dB Day-Night Sound Level (DNL) and above was 55 percent lower than in 2001. Winthrop, which has always experienced the highest levels of noise exposure of any community around Logan Airport, continued its decline in the number of people exposed to levels greater than 65 DNL. This number has dropped 81 percent since reaching its peak in 1998. The number of residents

exposed to noise over 75 DNL increased from 2004 but still remained below 2001 levels.

The 2005 Cumulative Noise Index (CNI) of 153.2 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. The CNI decreased slightly compared to 2004 even with a slight increase in the number of operations in 2005. This decrease is primarily due to decreased use of recertified aircraft by cargo operators. Massport provided sound insulation for 471 residential dwelling units in 2005. Since the program's inception, Massport has sound insulated a total of 9,086 dwelling units. The majority of the units insulated in 2005 were in Winthrop.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2006 EDR. I also strongly advise Massport to consider and address the numerous comments received that have raised noise related concerns in comments.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2005 and efforts to reduce emissions. The 2005 emissions inventory results are driven by the small increase in aircraft operations at Logan Airport compared to 2004 levels. Compared to 2004 levels, total emissions of volatile organic compounds (VOCs) are estimated to have decreased by approximately 6 percent to 1,285 kilograms per day (kg/day). In 2005, total emissions of oxides of nitrogen (NOx) were estimated to be 4,187 kg/day, which is a 2 percent decrease from 2004 levels. Total emissions of carbon monoxide (CO) in 2005 were 9,556 kg/day, or 3 percent lower than 2004 levels.

For the first time, estimates of particulate matter emissions associated with Logan Airport are reported in this 2005 EDR in response to the recent availability of an FAA-approved method for computing particulate matter emission factors for aircraft. Total emissions of particulate matter (PM2.5) at Logan Airport in 2005 were approximately 83 kg/day [33 tons/year (tpy)]. NOx emissions at Logan Airport in 2005 were approximately 662 tpy lower than 1999 levels—a 28 percent decrease. It appears that there is an ongoing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the general vicinity of Logan Airport. In addition, annual NO2 concentrations at all monitoring locations were well below the NO2 air quality standards in 2005. The 2006 EDR should continue updates on the information presented in the 2005 EDR.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. Specifically, of the 97 spills reported in 2005, 15 (15 percent) were ten gallons or greater in quantity. Jet fuel spills accounted for 66 (68 percent) of the total spills, 12 of the jet fuel spills (18 percent) were ten gallons or greater in quantity. The remaining 31 spills involved gasoline, hydraulic oil, diesel fuel, and other substances. Of these spills, only

three (10 percent) were ten gallons or greater. In 2005, only eight samples exceeded the regulatory limits. The North Outfall had two samples which exceeded the 15 milligrams per liter (mg/L) National Pollutant Discharge Elimination System (NPDES) limit for oil and grease, and the Porter Street Outfall had one sample exceed this limit. The North Outfall had two samples which exceeded the 0.3 milliliters per liter (ml/L) daily maximum limit for settable solids, and the West Outfall had three samples exceed this limit. No other exceedances occurred. In accordance with the Massachusetts Contingency Plan (MCP), Massport should continue to report in the 2006 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision. This chapter describes Massport's continued efforts.

As I stated at the beginning of this Certificate, the 2006 EDR must provide responses to the issues raised in comments received. The 2006 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2005 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, and noise abatement. Massport should consult directly with individual commentors where necessary.

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February 15, 2007
Date

Ian A. Bowles

Comments Received:

01/30/07	State Representative Robert A. DeLeo
01/31/07	Joseph Felzani
02/05/07	Boston Transportation Department
02/06/07	Nancy Timmerman
02/07/07	Stephen Kaiser
02/13/07	City of Boston Environment Department

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November 1, 2007

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2006 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2006 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: September 25, 2007

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massport's long range planning. In recognition of the increased role of planning in the GEIR process, the name of the document was changed to ESPR. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a 5-year basis, with much less detailed Environmental Data

Reports (formerly Annual Updates) filed in the years between ESPRs. The 2006 EDR is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2006 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2006. In particular, the technical studies in the 2006 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2006 EDR

As always, EEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2006 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2006 EDR details how Massport is meeting this commitment. The 2007 EDR should continue to report on the details of Massport's commitment and address the concerns raised by the City of Boston's Environment Department on this issue. In addition to the environmental issues listed below, the 2007 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2006 EDR.

Procedural

Given the overall strength of the analysis in the 2006 EDR, the 2007 EDR can restrict itself to providing an update on 2007 conditions, and respond to those issues explicitly noted in this

Certificate and the comments received as requiring response in the next EDR. The EDR should provide a "snapshot" of the 2007 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2007 EDR no later than October 15, 2008 (although I encourage Massport to file sooner, given the relatively few requirements for the next EDR).

A distribution list for the 2007 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The comments received on the 2006 EDR are thoughtful and detailed although I note that some of the comments were received only one day before this Certificate was to be issued. I request that during the review of the 2007 EDR that commenters make every attempt to submit comments by the close of the comment period to allow time for review. The 2007 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2006 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2007 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where necessary.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2006 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2006 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. Air passenger traffic at Logan Airport reached 27.7 million, up from 27.1 million in 2005. The total number of aircraft

operations decreased in 2006 even though the total number of air passengers increased because airlines increased the number of passengers per aircraft operation. Specifically, the total number of aircraft operations declined from 409,066 in 2005 to 406,119 in 2006 which is a decrease of 0.7 percent. Air cargo volumes continued to decline from 728 million pounds in 2005 to 679 million pounds in 2006 with the largest volume decrease in the express/small packages. I advise Massport to consider and attempt to address all comments related to activity levels in the next 2007 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2006. It also describes known future planning, construction, and permitting activities. Specifically, several projects were completed in 2006. The new Terminal A, which opened on March 16, 2005, achieved Leadership in Energy and Environmental Design (LEED) certification in June 2006. It is the first airport terminal in the U.S. to earn this ranking. In addition, in November, 2006 the MBTA Silver Line service was enhanced with the addition of the Massachusetts Bay Transportation Authority's (MBTA) Charlie Card automatic fare collection kiosks in all Logan Airport terminals. Several construction projects were also completed, including the construction of the North Service Road (SR-2) Roadway Buffer, which consists of a sidewalk linking the Blue Line Airport Station to Logan Airport Terminals, and a landscaped area adjacent to the sidewalk. Construction of Phase 1 of the Southwest Service Area (SWSA) buffer, which began in 2005, was completed in the fall of 2006, and the Navy Fuel Pier Edge Buffer was completed in December 2006.

Regional Transportation

This chapter describes activity levels at New England's regional airports in 2006 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2006 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

In general, the 2006 EDR has met the requirements laid out in the ESPR Certificate. The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2006 EDR has performed this task.

Overall, the number of air passengers utilizing New England's primary commercial service airports in 2006 declined marginally, from 48.0 million to 47.9 million. When measured by the number of aircraft operations, however, activity levels fell by 4.4 percent, from 1.4 million operations to 1.3 million operations. This reflects substantial changes in the commercial aviation sector and the continued decline of general aviation (GA) noted in the 2005 EDR. Major airlines

reduced capacity at the regional airports in 2006 as they reconfigured their operations in an effort to consolidate gains made in bankruptcy and near-bankruptcy restructuring. Passenger declines were generally consistent with capacity reductions. In addition, the average aircraft size of scheduled flights to the regional airports declined in 2006 as airlines substituted regional jet service for mainline jets on certain routes. Declines in GA activity in New England (declined by 4.2 percent from 2005 levels) continue to outpace declines in the rest of the country. According to the FAA as reported in the 2006 EDR, GA activity declined by 1.3 percent nationally in 2006, largely due to rising fuel costs.

Ground Transportation

The 2006 EDR serves its purpose of updating 2006 ground access conditions on the airport, and has also adequately addressed the larger ground access issues identified in previous Certificates, as discussed below.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2006. Specifically, ground transportation activity levels increased across the board from 2005 to 2006 as a result of a 2.4 percent increase in the number of air passengers. Also, a portion of I-90 connecting the City of Boston and areas to the south and west of Boston to Logan Airport was closed from July 2006 until early 2007, which is believed to have reduced traffic flows to and from the Airport. The 2006 EDR reports that ridership on the MBTA, Logan Express, water transportation, scheduled and unscheduled HOV Services, and taxis increased in 2006. This is due in part to the completion of roadway and other construction projects at the Airport, and to the closure of the I-90 connector to the Airport for much of 2006. Massport-subsidized service provided by the C & J Bus Company began in 2006 providing early morning transportation between New Hampshire and Logan Airport. The 2006 EDR also reports that the number of on-Airport parkers decreased by 8.4 percent in 2006.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2006, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring a point raised by several commenters. The EDR represents an appropriate forum to serve this updating function.

In 2006, the overall number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) decreased in 2006 compared to 2005. An estimated 5,583 people were exposed to DNL levels greater than 65 dB in 2006, compared to 6,477 in 2005, and 9,438 in 2004. For the second year in a row, fewer than 7,000 people experienced levels of 65 dB DNL and above. The 2006 Cumulative Noise Index (CNI) of 152.6 Effective Perceived Noise Level (EPNdB) remained well below the cap of 156.5 EPNdB. The CNI decreased compared to 2005

primarily because of decreased use of recertificated aircraft by cargo operators.

Massport provided sound insulation for 857 residential dwelling units in 2006. This is the largest number of units to receive sound insulation in the vicinity of the Airport in any one year since the beginning of the program. Since the program's inception, Massport has sound insulated a total of 9,943 dwelling units. The majority of the units insulated in 2006 were in Chelsea.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2007 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2006 and efforts to reduce emissions.

The emissions inventory results are driven largely by improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.0.1. These include the addition of aircraft main engine startup VOC emissions; adjustments to how aircraft performance profiles are modeled, which changed aircraft times-in-mode and thus emissions of all pollutants; an advanced method to calculate aircraft PM10/PM2.5 emissions; and updated ground support equipment (GSE) emission factors using NONROAD2005. The in-place air quality initiatives at Logan Airport and other ongoing efforts by Massport to minimize emissions also played a role, as did changes to aircraft taxi time, fleet mix, and number of operations.

The 2006 EDR reports that emissions inventory changes show an increase in VOC over 2005 levels attributed to the changes to EDMS. The 2006 EDR reported that total VOC emission number is up 34 percent (1,724 kg/day). The total NO_x emissions were one percent lower than reported in the 2005 EDR. In 2006, NOx emissions at Logan Airport were approximately 677 tons per year (tpy) lower than the 1999 threshold level established by Massport's Air Quality Initiative. This represents a 28 percent decrease since1999. There was a continuing trend of decreasing NO2 concentrations at both the Massport and Massachusetts Department of Environmental Protection (MDEP) monitoring sites located in the general vicinity of Logan Airport. In addition, in 2006 the annual NO2 concentrations at all monitoring locations were well below the NO2 air quality standards.

For the second year (2005 EDR was the first year), estimates of particulate matter emissions associated with Logan Airport are reported in this 2006 EDR in response to the recent availability of an FAA-approved method for computing particulate matter emission factors for aircraft. The total CO decreased 15 percent and the total PM_{10} /$PM_{2.5}$ decreased seven percent below the 2005 EDR reported numbers.

The 2006 EDR emissions inventory analysis used the actual aircraft fleet mix, except in the few

instances where aircraft/engine types or combinations were not available in the EDMS database. Data included aircraft type, engine, landing and takeoff operations (LTOs) and aircraft taxi times. Aircraft types are divided into four categories: commercial air carriers, commuter aircraft, general aviation and cargo.

The 2007 EDR should continue updates on the information presented in the 2006 EDR and address comments received related to air quality. In particular the City of Boston has raised several concerns the Massachusetts Department of Public Health's (DPH) Logan Airport Health Study and the air quality monitoring study. The 2007 EDR should update the status of discussions with the City of Boston related to this concern.

Last, I ask that Massport consult with the MEPA office regarding the recently promulgated Greenhouse Gas Emissions Policy and Protocol prior to subsequent filings.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. Specifically, Logan Airport experienced 92 hazardous material spills in 2006, 11 (12 percent) were considered reportable (i.e., over 10 gallons) under the applicable environmental regulations. Jet fuel spills accounted for 65 (71 percent) of the total spills, with nine of the jet fuel spills exceeding 10 gallons. The remaining 27 spills (29 percent) involved gasoline, hydraulic oil, diesel fuel, and other substances, including two reportable spills.

In 2006, only four of 332 outfall samples exceeded the regulatory limits. The West Outfall and the Maverick Street Outfall each had one sample which exceeded the 15 milligrams per liter (mg/L) National Pollutant Discharge Elimination System (NPDES) limit for oil and grease. The North Outfall had two samples which exceeded the 0.3 milliliters per liter (ml/L) daily maximum limit for settable solids. This is an improvement compared to 2005, when eight samples exceeded the regulatory limits. In accordance with the Massachusetts Contingency Plan (MCP), Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. In 2006, two of its five MCP sites were closed out, and Massport was working towards achieving regulatory closure of the three remaining MCP sites. In accordance with the Massachusetts Contingency Plan (MCP), Massport should continue to report in the 2007 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable

design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance.

Massport has been a leader in sustainable development. Terminal A, which opened in 2005, received LEED certification in 2006. It is the first airport terminal in the country to receive such certification, and is a model for other airports in the country. In addition, in an effort to reduce air pollutants, Massport is phasing in alternative fuel vehicles in place of conventionally-fuel vehicles. At the airport, Massport maintains electric vehicles infrastructure, as well as a privately operated CNG station to power newer vehicles. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2007 EDR.

November 1, 2007
Date

Ian A. Bowles

Comments Received:

10/24/07	Nancy Timmerman
10/25/07	Stephen Kaiser
10/26/07	**Town of Lincoln**, Lincoln Board of Selectmen
10/31/07	City of Boston's Environment Department
10/31/07	The Boston Harbor Association

IAB/ACC/acc

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October 31, 2008

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2007 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2007 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: September 24, 2008

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massport's long range planning. In recognition of the increased role of planning in the Generic Environmental Impact Report (GEIR) process, the name of the document was changed to ESPR. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a 5-year basis, with much less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The 2007 EDR is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2007 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2007. In particular, the technical studies in the 2007 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2007 EDR

As always, EEA remains committed to evaluating and addressing the cumulative impacts of airport operations on the nearby communities. In June 2001, Massport agreed to work with EEA on structuring a proposed Air Quality Initiative (AQI). The Certificate indicated that Massport was "to solicit project submissions from local governments and community groups, which will be reviewed in an objective, science-based process by a neutral organization such as NESCAUM." The 2007 EDR reiterates that Massport has committed to the Air Quality Initiative, a key program designed to mitigate the cumulative air quality impacts of airport operations. The 2007 EDR details how Massport is meeting this commitment. The 2008 EDR should continue to report on the details of Massport's commitment and address the concerns raised by the commenters on this issue. In addition to the environmental issues listed below, the 2008 EDR should address all of the air quality and noise related issues raised by the commenters during the review of the 2007 EDR.

Procedural for 2008 EDR

Given the overall strength of the analysis in the 2007 EDR, the 2008 EDR can restrict itself to providing an update on 2008 conditions, and respond to those issues explicitly noted in this Certificate and the comments received as requiring response in the next EDR. The EDR should

provide a "snapshot" of the 2008 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2008 EDR no later than October 15, 2009 (although I encourage Massport to file sooner).

A distribution list for the 2008 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The comments received on the 2007 EDR are thoughtful and detailed. The 2008 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2007 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2008 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2007 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2007 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. In 2007, the total number of air passengers reached 28.1 million, up from 27.7 million in 2006. The increase in the total number of air passengers at Logan Airport was 1.4 percent compared to 2.4 percent in the previous year. Specifically, the total number of aircraft operations declined from 406,119 in 2006 to 399,537 in 2007, a decrease of 1.6 percent. Operations by general aviation (GA) aircraft

decreased most significantly (8.9 percent) in 2007 as compared to passenger and cargo operations. As a result of continued passenger growth and a reduction in operations, the number of air passengers per aircraft operation continued to increase in 2007. Air cargo volumes, continued to decline from 679 million pounds in 2006 to 632 million pounds in 2007. In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2008 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2007. It also describes known future planning, construction, and permitting activities. Several projects were completed in 2007 including the International Gateway Project (Terminal E) Phase 2. The Federal Inspection Services (FIS) facility was enlarged and the new arrivals level was constructed with the other Phase 2 improvements. The replacement GA Facility in the North Cargo Area was completed and opened in June, 2007 and the southwest corner of Taxiway D was realigned. In addition, the Terminal Area Roadway Landscaping was completed in 2007 and significant portions of Bremen Street Park were completed in early 2007. Also Phase II of the West Garage Project was completed which added three levels of parking to the Central Garage.

Regional Transportation

In general, the 2007 EDR has met the requirements laid out in the ESPR Certificate with respect to regional transportation issues. This chapter describes activity levels at New England's regional airports in 2007 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2007 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions. The total number of air passengers using New England's primary commercial service airports in 2007 increased marginally, from 47.13 million in 2006 to 47.2 million. Of the 47.2 million air passengers using New England's primary commercial service airports in 2007, 60 percent utilized Logan Airport as compared to 88 percent in 1995. When measured by the number of aircraft operations, activity levels fell by 2.1 percent, from 1.33 million operations in 2006 to 1.31 million operations in 2007.

The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2007 EDR has performed this task. I direct Massport to continue the directive from the ESPR Certificate for the 2008 EDR.

This chapter also reflects that passenger traffic at the regional airports fell by 1.6 percent. Major airlines reduced capacity at the regional airports in 2007 because they eliminated unprofitable

routes and reduced their domestic flying to deal with the high and rising cost of fuel. Passenger declines were generally consistent with capacity reductions. Declines in GA activity in New England (declined by 3.5 percent compared with 2.6 percent nationally in 2007) continue to outpace declines in the rest of the country, which is largely attributed to the impact of rising fuel costs on recreational flying.

Ground Transportation

The 2007 EDR serves its purpose of updating 2007 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2007. Specifically, ground transportation activity levels increased across the board from 2006 to 2007 as a result of a 1.4 percent increase in the number of air passengers. The re-opening of Interstate 90 (I-90) connecting the City of Boston and areas to the south and west of Boston to Logan Airport resulted in increased traffic flows to and from the Airport when compared to previous years. The 2007 EDR reports that ridership on water transportation, scheduled and unscheduled high occupancy vehicle (HOV) services, and employee ridership on Logan Express increased over 2005 levels. The 2007 EDR also reports that the number of on-Airport parkers decreased by 16.9 percent in 2007 compared to 2005. A portion of this decrease is likely due to the increase of pick-up and drop-off at the Airport.

I also note that this chapter discusses that the Logan Employee Transportation Management Association (Logan TMA) introduced and implemented three new programs to support employees' use of alternative transportation options: the Sunrise Shuttle, which provides shuttle services between 3:00 AM and 5:30 AM for Airport employees who reside in East Boston; the Logan TMA Preferential Carpooling, which provides free terminal garage parking to employees in Logan TMA member companies who carpool in groups of three or more; and the Commuter Cash program, which financially rewards employees ($3/day) who switch from driving alone to either carpooling, bicycling, walking, or using public transportation. The 2008 EDR should continue to update 2008 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2007, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring, a point raised by several commenters. The future 2008 EDR represents an appropriate forum to serve this updating function.

2007 was the first full year of operation for Runway 14-32. Consistent with the 2002 Record of Decision (ROD) on the Airside Improvements Planning Project and based on FAA data, the runway was used primarily for arrivals over Boston Harbor during 2007. Consistent with historical patterns, despite the introduction of Runway 14-23, the FAA continued to rely on Logan Airport's north-south traffic flow in 2007. However, within the north-west flow, the FAA increased reliance on Runway 33L for departures with an associated reduction in Runway 27 departures. The changes in runway utilization in 2007 have led to changes in the noise environment. Since 2006, the noise contours over East Boston increased in extent and, over the same period, decreased over South Boston, Revere, and Winthrop.

The population within the 75-80 decibel (dB) DNL contours decreased in 2007 compared to 2006. In 2006, the population in the 75-80 dB DNL contour was 104 but in 2007 zero population was located in this coutour. In 2006, the population in the 70-75 dB DNL contour was 597 compared to 416 in 2007. The overall number of people exposed to Day-Night Sound Level (DNL) values greater than 65 decibels (dB) increased 36 percent compared to 2006. An estimated 7,591 people were exposed to DNL levels greater than 65 dB in 2007, compared to 5,583 in 2006. This is still well below the pre-September 11, 2001, level of 17,745. The residences exposed to DNL levels greater than 65 dB in 2007 are located within the 65 dB sound insulation contour, and thus are within areas that have been sound insulated by Massport. The comments from the Boston Transportation Department, the City of Cambridge as well as from individuals such as Mr. Peter Koff and Ms. Nancy Timmerman have raised a number of concerns and suggestions related to noise that Massport should consider incorporating into the 2008 EDR.

In 2007, Massport provided sound insulation to 548 homes, the majority of which were in Chelsea. Since the inception of Massport's Sound Insulation program, 10,461 homes in East Boston, South Boston, Winthop and Chelsea have received sound insulation.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2008 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2007 and efforts to reduce emissions. The emissions inventory results were driven largely by three factors: changes in the aircraft fleet mix at the Airport (the airlines' substitution of select narrow-body aircraft with wide-body and commuter aircraft); the reported change in the aircraft average taxi/delay times at Logan Airport; and continual improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.0.2, particularly in regard to the advanced method for calculating particulate matter (PM) emissions from aircraft engines. Because of the changes to the EDMS model, total modeled emissions of PM10/PM2.5 associated

with Logan Airport in 2007 appeared to have increased by approximately 64 percent to 128 kilograms per day (kg/day) compared to 2006 levels. By comparison, using the EDMS version available in 2006 (v5.0.1) total emissions of PM10/PM2.5 would have increased by approximately 5 percent to 82 kg/day due to a combination of changes in aircraft fleet mix and aircraft taxi/delay time. This data shows that the estimated increase in PM10/PM2.5 was due mostly to the updated EDMS model and not the result of significant changes in Airport operations. Nonetheless, the increases in modeled emissions are notable and I encourage Massport to revisit all feasible efforts to mitigate PM10/PM2.5 emmissions.

The 2007 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,673 kg/day, or 3 percent lower than 2006 levels. Total emissions of carbon monoxide (CO) were 9,233 kg/day, or 13 percent higher than 2006 levels. Total emissions of oxides of nitrogen (NOX) were 4,457 kg/day, or 7 percent higher than 2006 levels. In 2007, total NOx emissions at Logan Airport were approximately 541 tons per year lower than the 1999 Air Quality Initiative (AQI) benchmark which represents a 27 percent decrease in NOx emissions at Logan Airport since 1999. There was also a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MA DEP) monitoring sites located in the general vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2007 were within the NO2 Air Quality Standards.

In the 2007 EDR Massport for the first time has voluntarily submitted its first emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. "Direct emissions" are those that occur in areas located within the Airport's geographic boundaries and "indirect emissions" are those that occur off the Airport site. "Direct" GHG emissions associated with Logan Airport in 2007 were 0.37 million metric tons (MMT), and the sum of "direct" and "indirect" emissions was 0.69 MMT (less than 0.1 percent of state-wide totals). Massport has control of only 18 percent of these combined totals and will implement plans by 2009 to reduce further GHGs associated with its operations at Logan Airport helping minimize the Airport's carbon footprint.

The 2008 EDR should continue updates on the information presented in the 2007 EDR and address comments received related to air quality. In particular the Mr. Peter Koff has raised several concerns related to air quality monitoring and the Massachusetts Department of Public Health's (DPH) Logan Airport Health Study. The 2008 EDR should clarify this issue and update the status of any air quality monitoring related to this concern.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management.

I note on July 31, 2007, the Environmental Protection Agency (EPA) and MA DEP issued a new National Pollutant Discharge Elimination System (NPDES) Program permit for Logan Airport's stormwater outfalls. The new NPDES permit regulates stormwater discharges from the North, West, Northwest, Porter Street, and Maverick Street Outfalls, and all of the airfield outfalls. The previous NPDES permit regulated stormwater discharges only from the North, West, Porter Street, and Maverick Street Outfalls. The new NPDES permit also has additional sampling requirements, including the requirement to sample for deicing compounds. In 2007, three of 404 outfall samples exceeded the regulatory limits contained in the NPDES permit. The Maverick Street Outfall had two samples exceed the 100 milligrams per liter (mg/L) daily maximum limit for Total Suspended Solids (TSS) and the West Outfall had one sample exceed this limit. This is an improvement compared to 2004 and 2006 when four samples exceeded the regulatory limits, and 2005 when eight samples exceeded the regulatory limits.

In 2007, Massport completed an update to the Airport's Stormwater Pollution Prevention Plan (SWPPP). The SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. Best management practices (BMPs) are included in the SWPPP. Also in accordance with the Massachusetts Contingency Plan (MCP), Massport continued to assess, remediate, and bring to regulatory closure areas of subsurface contamination. In 2007, Massport worked towards achieving regulatory closure of six remaining MCP sites. Massport should continue to report in the 2008 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The replacement GA Facility in the North Cargo Area, which was constructed in early 2007 and opened in June 2007, is an example of planning and design sustainability initiatives being undertaken at Logan Airport. The new GA Facility incorporates sustainable design, construction, and operational elements. On the operations and maintenance in 2007, Massport created preferred parking areas in garages and

parking areas throughout Logan Aiport to promote use of lower emitting vehicles. In cooperation with the City of Boston, in the spring of 2007, Massport began a limited head-of-line privilege program for taxis using AFVs, helping to increase the use of alternatively-powered taxis. Additionally, in 2007, Massport created a Cell Phone Waiting Lot, a new parking area where drivers picking up arriving passengers can park for a maximum of 30 minutes. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2008 EDR.

Conclusion

As I stated at the beginning of this Certificate, the 2008 EDR must provide responses to the issues raised in comments received. The 2008 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2007 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues. Massport should consult directly with individual commentors where appropriate.

October 31, 2008
Date

Ian A. Bowles

Comments Received:

10/20/2008 Boston Transportation Department
10/20/2008 Peter L. Koff, Engel & Schultz, LLP
10/24/2008 Stephen H. Kaiser, PhD
10/27/2008 City of Cambridge, Robert Healy, City manager
10/28/2008 Nancy Timmerman

IAB/ACC/acc

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November 13, 2009

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2008 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2008 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 7, 2009

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long range plans. It has thus become (consistent with the objectives of the MEPA regulations) part of Massport's long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific EIRs. The ESPR is currently updated on a 5-year basis, with less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The EDR addressing airport operations during 2008 is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a “snapshot” of year 2008 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2008. In particular, the technical studies in the 2008 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. These commitments take the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary’s Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

The last Logan ESPR was filed for calendar year 2004. Following the recent sequence of annual environmental filings, the environmental filing scheduled for next year was previously anticipated to be in the form of an ESPR rather than an EDR. However, due to the current economic downturn, as described in this 2008 EDR, activity levels at Logan Airport and associated environmental impacts continue to remain well below historic levels and recent peaks. In 2009, near-term activity levels and associated environmental effects are also expected to remain well below levels previously analyzed for Logan Airport. Thus, the forecasted aviation growth presented in the 2004 ESPR, the predicate upon which the ESPR schedule was initially established, has not occurred. Therefore, I will allow Massport to prepare a 2009 EDR in lieu of the scheduled ESPR. The 2009 EDR should address the activity levels observed in 2009 in comparison with those predicted in the 2004 ESPR. The 2009 EDR should explain Massport’s proposed schedule for filing the next ESPR in light of observed and expected activity levels and any other changes in airport operations that have occurred since the 2004 ESPR was filed. Where appropriate, Massport must continue to identify and address any longer term aviation and environmental trends in each annual filing whether that will be in the form of an EDR or ESPR.

Review of the 2008 EDR and Scope for the 2009 EDR

Procedural for 2009 EDR

The 2009 EDR must provide an annual update on conditions at Logan Airport for calendar year 2009. The 2009 EDR should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to 2008.

The 2009 EDR must respond to those issues explicitly noted in this Certificate and the comments received in the next EDR. The EDR should provide a "snapshot" of the 2009 operations and impacts, with more substantial analysis awaiting the next ESPR. Massport should file the 2009 EDR no later than October 15, 2010.

A distribution list for the 2009 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The comments received on the 2008 EDR are thoughtful and detailed. The 2009 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2008 EDR focused on air quality and noise related issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2009 EDR and future EDRs should also continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Organization of the Certificate

I have organized the remainder of this Certificate to respond to issues raised roughly in the order in which they were presented in the 2008 EDR, although I have for the most part incorporated discussion of issues raised in the technical appendix into the discussion of the environmental impact analyses.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2008 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. The total number of air passengers at Logan Airport dropped to 26.1 million from 28.1 million in 2007. The decrease in the total number of air passengers was 7.1 percent. In addition, the total number of aircraft operations declined from 399,537 in 2007 to 371,604 in 2008, a decrease of 7 percent. The 2008 EDR also reports that the passenger aircraft operations decreased by 6.4 percent and operations by general aviation (GA) aircraft also declined by 16.8 percent from 2007. The average domestic load factor (average number of passengers per available seat) for flights also dropped to 72.8 percent, from 74.9 percent in 2007. However, the number of air passengers per aircraft operation was similar to the previous year with an average of 70.2 passengers per aircraft operation in 2008. In response to high and rising fuel prices and declining passenger demand, both low-cost carriers (LCCs) and legacy airlines reduced the number of aircraft operations at Logan Airport. Air cargo volumes, excluding mail, continued to decline from 632 million pounds in 2007 to 588 million pounds in 2008.

For the 2009 EDR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities;
- A comparison of the 2009 aircraft operations, cargo/mail operations, and passenger activity levels to 2008 activity levels; and
- A report on national aviation trends in 2009 and a comparison to trends at Logan Airport.

In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2009 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2008. It also describes known future planning, construction, and permitting activities. In 2008 the replacement Signature Flight Support GA Facility in the North Cargo Area (NCA) was certified under the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) Green Building Rating System. In addition, several other projects were also completed in 2008. The southwest corner taxiway system was realigned and the northern portion of the centerfield taxiway was constructed and was operational in 2008. Also Phase 1 of the Consolidated Maintenance Facility was constructed in the NCA and Phase 2, involving rehabilitation of the existing Facilities Building Number 2, began. Massport also completed renovations of the existing gas station in the NCA, which included installing Logan Airport's first E85 fuel dispensing tank. (E85 is an alcohol fuel

mixture that typically contains a mixture of up to 85 percent denatured ethanol and gasoline or other hydrocarbon.) In 2008 Massport also completed the final construction of the Bremen Street Park. In addition, a security wall was installed along the perimeter of the air operations area in the North Service Area.

For the 2009 EDR, the Airport Planning chapter should describe the status of planning initiatives for the:

- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The chapter should also report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. Massport should continue to assess planning strategies for improving Logan Airport's operations and services in a, safe, secure, efficient, and environmentally sensitive manner.

Regional Transportation

In general, the 2008 EDR has met the requirements with respect to regional transportation issues. This chapter describes activity levels at New England's regional airports in 2008 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2008 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions. The total number of air passengers utilizing New England's primary commercial service airports decreased from 47.2 million in 2007 to 44.4 million in 2008. This represents a passenger traffic decline of 5.9 percent. Activity levels as measured by the number of aircraft operations fell by 7.7 percent, from 1.31 million operations in 2007 to 1.21 million operations in 2008.

The decreases in passenger traffic and aircraft operations at New England airports reflect national trends in the face of volatile fuel prices and a worsening global economy. Specifically, of the 44.4 million air passengers using New England's primary commercial service airports, 59 percent of air passengers used Logan Airport in 2008 and 60 percent in 2007, as compared to 88 percent in 1995. In addition, air passenger traffic in the region fell more quickly than in the overall U.S. domestic market. As reported in the 2008 EDR, airlines introduced major reductions in operations through the year, eliminating less profitable routes and cutting frequencies in smaller markets. Fuel prices also forced airlines to ground less fuel efficient aircraft, as well as aircraft with high per seat operating costs, such as the small regional jets (with 50 seats or fewer) prevalent at the regional airports. As a result, the average number of seats per scheduled flight at the regional airports increased from 84 in 2007 to 88 in 2008. In comparison to 2007 levels, the operations by GA aircraft at New England regional airports declined by 7.6

percent. Declines in GA activity in New England also outpaced declines in the rest of the country. According to the FAA, GA activity fell by 5.6 percent nationally in 2008, due to high fuel costs resulting in a sharp decrease in recreational flying.

The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2008 EDR has performed this task.

I direct Massport to continue the directive from the ESPR Certificate for the 2009 EDR. In addition, for 2009 EDR the chapter on Regional Transportation should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System:

Regional Airports

- 2009 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground Access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's efforts in strengthening the regional transportation system;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2008 EDR serves its purpose of updating 2008 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2008. Specifically, ground transportation activity levels associated with Logan Airport generally decreased for all surface transportation modes from 2007 to 2008 as a result of a 7 percent decline in the annual number of air passengers. In addition, the average daily traffic on Airport roadways decreased by 13 percent from 2007 to 2008, while vehicle miles traveled (VMT) decreased by 11 percent. This can be attributed directly to a decrease in annual passengers at the Airport. Air passenger ridership on Logan Express bus service also decreased by 14 percent in 2008 compared to 2007. However, Silver Line boardings at the Airport increased 5 percent. The increase in Silver Line ridership is likely due to new ridership as well as diversion from other services, such as from water transportation, limousines, and taxis. Ridership on water transportation decreased by 12 percent, limousine ridership decreased by 19 percent, and taxi

dispatches decreased 9 percent.

The 2008 EDR also documented that over the past several years, transit services have seen substantial increases in employee use. In 2008, the number of employees using Logan Express increased by 7 percent. In 2008, the Logan Transportation Management Association (Logan TMA) continued the operation of three programs that were introduced in 2007: 1) Sunrise Shuttle, which provides shuttle services between 3:00 A.M. and 5:30 A.M. for Airport employees who reside in East Boston; 2) Logan TMA Preferential Carpooling, which provides free parking at the West Garage to employees of Logan TMA member companies who carpool in groups of three or more; and 3) the Commuter Cash program, which financially rewards employees ($3/day) who switch from driving alone to either carpooling, bicycling, walking, or using public transportation. The number of vehicles parked on-Airport decreased by 14 percent in 2008 compared to 2007. The most significant change to the parking supply was the 40 percent reduction of spaces in the Economy Lot due to construction activities during most of the year.

The 2009 EDR should continue to update 2009 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options. The chapter should also report on 2009 conditions and provide a comparison of 2009 findings to those of 2008 for the following:

- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) membership and services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT). VMT will be calculated using the updated model created in 2004 that is based on the full build roadway network;
- Parking demand and management (including rates and duration statistics); and
- Ground access management strategy.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2009, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring, a point raised by several commenters. The future 2009 EDR represents an appropriate forum to serve this updating function.

The decrease in aircraft operations in 2008 led to changes in the noise environment. The 2008 Day-Night Sound Level (DNL) contours were smaller in almost all locations compared to 2007. The 65 decibel (dB) DNL contour decreased in size in East Boston pulling back from

across the Chelsea River to the East Boston waterfront. Over Winthrop and Revere, the DNL 65 dB contour decreased slightly with additional reductions out over Boston Harbor. The population exposed to noise levels greater than DNL 70 dB decreased in 2008 compared to 2007. In 2007, the population exposed to noise levels greater than DNL 70 dB was 416 but in 2008 the number dropped to 249. The overall number of people exposed to DNL values greater than 65 dB decreased 26 percent in 2008 compared to 2007. An estimated 5,968 people were exposed to DNL levels greater than 65 dB as depicted in the 2008 contour, compared to 8,099 in 2007. The residences exposed to DNL levels greater than 65 dB in 2008 are located within the 65 dB sound insulation contour, and thus are within areas that already have been sound insulated by Massport.

In 2008, Massport provided sound insulation to 388 homes, the majority of which were in Chelsea. The focus of this program in Chelsea is to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's Sound Insulation program, 10,849 homes have received sound insulation in East Boston, South Boston, Winthrop, and Chelsea.

In 2008, Massport continued installing an improved Noise Monitoring System (NOMS). The flight tracking system and all new noise monitors were operational in 2008. Combined with new noise monitor software, the system has an improved capability of correlating measured noise events with individual flight tracks. This has greatly reduced differences between measured and modeled DNL values.

The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2009 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns. Several commenters have requested further explanation of the reasons for the increased use of Runway 33L for jet aircraft departures and corresponding decrease in use of Runway 27. The comments from the Boston Transportation Department, the Town of Winthrop, the City of Cambridge, as well as from individuals such as Mr. Peter Koff and Ms. Nancy Timmerman have raised a number of concerns and suggestions related to noise that Massport should incorporate into the 2009 EDR.

For 2009 the Noise Abatement chapter should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2009 conditions and compare 2009 conditions to those of 2008 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and any qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) compliance; and
- Flight tracks, including a discussion of the update on the Standard Terminal Automation

Replacement System (STARS) radar and consolidation of the Boston Terminal Radar Approach Control (TRACON) at Merrimac, plus Massport's installation and use of PASSUR data.

The chapter should also report on 2009 conditions and compare those to 2008 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContours and RealProfiles, produce an accurate set of Day-Night Sound Level (DNL) noise contours. Adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain will be reported;
- Noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContours and RealProfiles;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The chapter should also report on noise abatement efforts and provide a status update on the new noise and operations monitoring system.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2008 and efforts to reduce emissions. The modeled emissions inventory results were driven principally by three factors: the lower number of aircraft operations at Logan Airport compared to 2007; the reported change in the aircraft average taxi/delay times at the Airport; and continual improvements to the FAA Emissions and Dispersion Modeling System (EDMS), v5.1, which has revised methods for calculating particulate matter (PM) and hydrocarbon (HC) emissions from aircraft engines, and has new functionality of calculating PM emissions from auxiliary power units (APUs). Because of the changes to the EDMS model and decreased air traffic, total emissions of PM10/PM2.5 associated with Logan Airport have decreased by approximately 37 percent to 81 kilograms per day (kg/day) compared to 2007 levels. By comparison, using the earlier version of EDMS total emissions of PM10/PM2.5 would have decreased by approximately 20 percent to 102 kg/day. This difference is attributed to modifications in the EDMS versions.

The 2008 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,208 kg/day, or 28 percent lower than 2007 levels. The total emissions of carbon monoxide (CO) were 8,361 kg/day, or 9 percent lower than 2007 levels and the total emissions of

oxides of nitrogen (NOX) were 4,204 kg/day, or 6 percent lower than 2007 levels. In 2008, total NOx emissions at Logan Airport (net total with reductions) were approximately 656 tons per year (tpy) lower than Massport's 1999 Air Quality Index (AQI) benchmark. This represents a 28 percent decrease in NOx emissions since 1999. The 2008 EDR notes that other contributing factors to the results of the emissions inventory include the change in stationary source fuel usage, and the change in VMT and parking volumes. Air quality initiatives in place at the Airport and other ongoing efforts by Massport to minimize emissions also played a role. For example, there is a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the general vicinity of Logan Airport since 1999. In addition, the annual NO2 concentrations at all monitoring locations in 2008 were well within the National Ambient Air Quality Standards (NAAQS) for NO2.

For the second year, Massport prepared an emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. "Direct" GHG emissions are those that occur in areas located within the Airport's geographic boundaries and "indirect emissions" are those that occur off the Airport site. "Direct" GHG emissions associated with Logan Airport were 0.35 million metric tons (MMT), and the sum of "direct" and "indirect" emissions was 0.65 MMT, or less than 1 percent of statewide totals. Massport operations at Logan Airport contribute only 18 percent of these combined totals. GHG emissions in 2008 were 6 percent lower than 2007 levels.

As part of the Section 61 findings for the centerfield taxiway component, the first phase of a two-phase Massport Air Quality Monitoring Study was initiated in September 2007 at ten locations on- and off-airport using both real time and time-integrated methods to measure fine particulates, volatile organic compounds (VOC), carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). The 2008 EDR states that this first phase commenced in September 2007 and was completed September 2008, with a report summarizing the findings expected to be completed before the end of 2009. Massport has committed to post this report on Massport's website when completed. The study collected ambient data on a variety of air pollutants over a two year period and assessed air quality changes due to the operation of the new centerfield taxiway. Massport should consult with the Massachusetts Department of Public Health (DPH), the Massachusetts Department of Environmental Protection (MassDEP), the City of Boston Environment Department and Boston Public Health Commission (BPHC) to discuss the second phase of the protocol.

The 2009 EDR should continue updates on the information presented in the 2008 EDR and address comments received related to air quality. For 2009 the Air Quality/Emissions Reductions chapter should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should also discuss analysis methodologies and assumptions and report on 2009 conditions using the most recent versions of the Emissions Dispersion Modeling System

(EDMS) and MOBILE motor vehicle emissions. The chapter should also include:

- Emissions inventory for carbon monoxide (CO);
- Emissions inventory for oxides of nitrogen (NOx);
- Emissions inventory for volatile organic compounds (VOCs);
- Emissions inventory for particulate matter (PM);
- Nitrogen dioxide (NO2) monitoring; and
- NOx emissions by airline.

This chapter should also report on the following air quality initiatives (AQI) for 2009:

- Air Quality Initiative Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of other Logan Airport air quality studies undertaken by Massport or others.

The Air Quality Chapter should also include an inventory of GHG emissions from Logan Airport in 2009. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the Greenhouse Gas Emissions Policy and Protocol issued by EEA. The results of the 2009 GHG emissions inventory should be compared to the 2008 results. The 2008 EDR indicates that Massport commissioned a study to evaluate operational, economic and environmental benefits of cogeneration as a way reduce air emissions associated with the Central Utility Plant. If cogeneration is found feasible, energy consumption could be reduced Airport-wide as could the emissions of criteria pollutants (i.e., CO, NOx, etc.) and GHGs. The status of this study is not described. Therefore, an update should be provided in the 2009 EDR.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. In accordance with the requirements of the current NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants.

The 2008 Annual Certificates of Compliance were submitted to U.S. Environmental Protection Agency and MA DEP in December 2008 for Massport and each co-permittee. Three out of a total of 73 outfall samples exceeded the regulatory limits of the National Pollutant Discharge Elimination System (NPDES) Program permit for the Airport's permitted outfalls. Two out of 23 samples exceeded the limits at the Maverick Street Outfall and one out of 24 samples exceeded a limit at the West Outfall. Over the past five years, the number of samples that exceeded the regulatory limits has ranged from three (2007) to eight (2005). Due to the large

size of the drainage areas and relatively low concentration of pollutants, it is typically not possible to trace exceedances to specific events. Where a known event, such as a spill, is reported, Massport routinely checks the drainage system for possible impacts from the event and takes corrective actions if necessary.

In accordance with the Massachusetts Contingency Plan (MCP), the 2008 EDR reports that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2008 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities, where fleet and field maintenance activities are conducted, was on-going in 2008.

For 2009 the Water Quality/Environmental Compliance and Management chapter should report on the 2009 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility
- Jet fuel usage and spills
- Massachusetts Contingency Plan (MCP) Activities
- Tank Management
- Update on the environmental management plan
- Fuel spill prevention
- Future stormwater management improvements (if any)
- Future MCP and tank management activities

Massport should continue to report in the 2009 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2009 EDR.

The 2008 EDR outlines how Massport is committed to sustainable practices to help reduce impacts associated with construction. For example, Massport requires contractors to comply with construction guidelines regarding demolition waste recycling, soil reuse, and air emissions from construction equipment. In addition, in 2008, Logan Airport became the first airport in the U.S. to use warm mix asphalt for its airfield pavement (Runway 4R). Warm-mix as opposed to hot-mix asphalt is heated to a lower temperature, which saves energy resulting in 20 percent lower GHG emissions than hot-mix asphalt. It also contains 18 percent recycled material. Another environmental benefit of warm mix asphalt is that it can be applied in a thicker layer, requiring fewer passes with construction vehicles and fewer emissions of associated pollutants.

Massport has several programs in place that contribute to the environmentally sustainable operation and maintenance of Logan Airport and its facilities. Massport also encourages its tenants to do the same. These programs and other sustainability initiatives include developing a policy that states that new development projects obtain certification under the U.S. Green Building Council Leadership in Energy and Environmental Design® (LEED) Green Building Rating System™ and include LEED accredited professionals on the design team. Massport is also establishing and implementing an Alternative Fuel Vehicle Policy (AFV) Policy that requires key personnel to review and consider AFVs when there is a request for a new or replacement vehicle and to select AFVs unless there is a compelling reason not to. In March 2008, Massport installed twenty 10-foot-tall wind turbines on the roof of Logan Office Center. The wind turbines are expected to generate approximately 100,000 kWh annually, or about 2 percent of the building's monthly energy use.

In 2008 Massport completed renovations to the existing gas station in the NCA to include installing an E85 fuel dispensing tank. As discussed earlier in this Certificate, E85 is a first-generation biofuel. Massport also established a bicycle security program with State Police Troopers providing additional patrols on bicycle, which helps to reduce vehicle-related emissions and fossil fuel use. Finally, Massport created preferred parking areas in garages and parking areas throughout Logan Aiport to promote use of lower emitting vehicles. I commend Massport for the existing and planned sustainability measures.

For 2009, this chapter should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported:

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Safety Improvements;
- Replacement Terminal A; and
- Logan Airside Improvements Planning.

This chapter should also update the status of Massport's mitigation commitments and identify

projects for which mitigation is complete.

Conclusion

I have determined that the 2008 EDR for Logan Airport has adequately compiled with MEPA and that Massport may prepare a 2009 EDR in lieu of a multi-year ESPR for submission in 2010. As I stated at the beginning of this Certificate, the 2009 EDR must provide responses to the issues raised in comments received. The 2009 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2008 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues. Massport should consult directly with individual commentors where appropriate.

November 13, 2009
Date

Ian A. Bowles

Comments Received:

10/26/2009	Peter L. Koff, Engel & Schultz, LLP
10/28/2009	Town of Winthrop, Noise Air Pollution & Airport Hazards Committee
11/05/2009	Nancy Timmerman
11/06/2009	City of Cambridge, Robert Healy, City Manager
11/09/2009	Boston Transportation Department
11/10/2009	City of Boston Environment Department

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Deval L. Patrick
GOVERNOR

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LIEUTENANT GOVERNOR

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November 12, 2010

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
2009 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2009 Environmental Data Report
PROJECT MUNICIPALITY	: Boston / Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority
DATE NOTICED IN MONITOR	: October 6, 2010

As Secretary of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00). The Proponent, the Massachusetts Port Authority (Massport) should submit an Environmental Data Report containing 2010 data no later than October 15, 2011.

The environmental review process at Logan Airport has been structured to occur on two levels: airport-wide and project-specific. With respect to airport-wide impacts, the periodic Environmental Status and Planning Report (ESPR) process has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long range plans. It has thus become part of Massport's long range planning (consistent with the objectives of the MEPA regulations), and a vehicle for analyzing cumulative impacts associated with airport operations. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation

commitments made by Massport in the context of project-specific environmental impact review. In addition, between preparation of each ESPR, Massport also provides more frequent (annual) Environmental Data Reports (EDRs) that contain data for the prior year's airport operations and impacts. EDRS also provide an updating on the status of outstanding mitigation commitments for all airport projects. The EDR addressing airport operations during 2009 is the subject of this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of year 2009 passenger and impact levels at Logan Airport. The technical studies in the 2009 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Most environmental parameters showed improvement in calendar year 2009. However, mitigation of noise impacts and air quality remain key concerns both of this office and the commenters. In addition, there appears to be a trend of increased parking demand at the airport that should be carefully monitored by Massport, and which requires a corresponding focus on increasing public transit use. Finally, assessing the cumulative changes in airport operations and impacts associated with several recent Massport projects (e.g., the Consolidated Car Rental Facility, the Green Bus Depot, the East Boston-Chelsea Bypass and the parking consolidation in the North Cargo Area/Robie parcel) should be a priority of the airport-wide impact assessment reports moving forward. I expect that these topics will be addressed by Massport in the 2010 EDR (to be filed by October 15, 2011) as outlined further below. The next ESPR document containing farther-reaching planning and assessment measures will need to be submitted the following year.

Environmental Data Reporting Process

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of periodic ESPR documents (typically every five years) and provides data updates annually through the EDRs.

The last Logan ESPR was filed for calendar year 2004. However, due to the current economic downturn, as described in this 2008 EDR submitted in the October, 2009, activity levels at Logan Airport and associated environmental impacts continued to remain well below historic levels. Therefore it was anticipated that in 2009, near-term activity levels and associated environmental effects were also expected to remain well below levels previously analyzed for

Logan Airport. As a result, the forecasted aviation growth presented in the 2004 ESPR, the predicate upon which the ESPR schedule was initially established, had not occurred. Therefore, I allowed Massport to prepare a 2009 EDR in lieu of the scheduled ESPR.

Massport has indicated in the 2009 EDR that in 2010, near-term activity levels and associated environmental effects continue to remain well below levels previously analyzed for Logan Airport. Because the forecasted aviation growth presented in the 2004 ESPR has not occurred, Massport has requested to delay filing of the next ESPR until 2011. In addition, Massport is also currently in the process of updating its passenger and operations forecast for the next twenty years. Significantly, this data will allow Massport to more accurately project passenger and operation needs that will directly influence planning for future projects at Logan Airport. The data from this forecasting process will not be available in time for filing the next annual report. Therefore, I will allow Massport to prepare a 2010 EDR followed by a 2011 ESPR (which will be filed in 2012, containing data for 2011 as well as more comprehensive analysis of future plans). Given the two-year extension of the original filing deadline for the ESPR document, I expect Massport to ensure that the 2011 ESPR will not be delayed any further.

REVIEW OF THE 2009 EDR AND SCOPE FOR THE 2010 EDR

General

The 2010 EDR must provide an annual update on conditions at Logan Airport for calendar year 2010. It should address the activity levels observed in 2010 in comparison with those predicted in the 2004 ESPR and should also report on the cumulative effects of Logan Airport operations and activities compared to 2009. The 2010 EDR should continue to serve as a background/context against which projects at Logan Airport can be evaluated. Where appropriate, Massport must continue to identify and address any longer term aviation and environmental trends that will impact airport impacts or planning.

The 2010 EDR must respond to those issues explicitly noted in this Certificate and the comments received in the next EDR. The EDR should provide a "snapshot" of the 2010 operations and impacts, while more substantial analysis and longer-range planning are expected to be presented in the next ESPR. Massport should file the 2010 EDR no later than October 15, 2011.

A distribution list for the 2010 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. In addition, the document should contain copies of any MEPA Certificates issued for projects at Logan airport in 2010. Supporting technical appendices should be provided as necessary.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2009 and compares activity levels to the prior year including air passengers, aircraft operations, fleet mix, and cargo/mail volumes. The total number of air passengers at Logan Airport during 2009 dropped to 25.5 million, compared to 26.1 million in 2008. The decrease in the total number of air passengers was 2.3 percent, compared to a decrease of 7.1 percent in the previous year. In addition, the total number of aircraft operations declined from 371,604 in 2008 to 345,306 in 2009, a decrease of 7.1 percent. The 2009 EDR also reports that the passenger aircraft operations decreased by 3.8 percent and operations by general aviation (GA) aircraft also declined by a dramatic 48.6 percent in 2009. Also the 2009 EDR reports that the cargo operations decreased by 23.2 percent in 2009, compared to 2008.

The EDR presents data indicating that the number of air passengers per aircraft operation increased, from an average of 70.2 passengers per aircraft operation in 2008 to an average of 73.9 passengers per aircraft operation in 2009. The passenger load factor (the percentage of seats occupied by revenue passengers) also increased slightly from 72.8 to 72.9. This reflects greater air carrier efficiency. While legacy airlines, such as Delta Air Lines, Continental Airlines, and US Airways, reduced aircraft operations significantly at Logan Airport, low-cost carriers (LCCs) operations increased by 12.3 percent. In addition to a continuing expansion in service offerings by JetBlue Airways, Logan Airport saw operations for two new LCCs, Southwest Airlines and Virgin America, begin in 2009. In addition, the 2009 EDR reports that the air cargo volumes declined 12.1 percent from 621 million pounds in 2008 to 546 million pounds in 2009. The largest volume decrease occurred in the express/small packages segment.

For the 2010 EDR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;
- Cargo and mail activities;
- A comparison of the 2010 aircraft operations, cargo/mail operations, and passenger activity levels to 2009 activity levels; and
- A report on national aviation trends in 2010 and a comparison to trends at Logan Airport.

In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2010 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2009. It also describes known future

planning, construction, and permitting activities. Construction of a 9,300-foot long centerfield taxiway (Taxiway M) was completed and opened in summer of 2009. Also in 2009 Massport continued the permitting for redevelopment of the Southwest Service Area (SWSA) at Logan Airport which includes consolidation of the rental car operations and their shuttle buses into a single coordinated operation that will result in reduced vehicle miles traveled and the associated air emissions. A Final EIR for the project was filed in March 2010, and a Certificate that determined that the EIR adequately and properly complies with MEPA. In addition, in 2009, Massport began the MEPA review process for the proposed Logan Runway Safety Area (RSA) Improvements at Runway ends 33L and 22R. A Draft EIR was submitted on that project in 2010. Preliminary design of a proposed Green Bus Depot for bus maintenance in the North Service Area (NSA) began in 2009 and an expanded ENF for the Green Bus Depot was filed in 2010.

During 2009 Massport published the Sustainable Design Standards and Guidelines (SDSG) for use by architects, engineers, and planners working on capital improvement projects for Massport facilities. The 2009 EDR reports multiple projects in the planning and design phase. Planning commenced for two hangar upgrades. Massport also commenced with Terminal B Garage repair and rehabilitation where solar panel "trees" were installed on the roof. An extension to Taxiway D was completed and the Taxiway G realignment construction commenced.

Planning for the North Service Area (NSA) Roadway Corridor project began. The NSA Roadway Corridor Project coordinates the roadway and urban design vision for North Service Road and Frankfort Street with ongoing design and construction efforts in the NSA. The 2009 EDR reports that the planning commenced for the Logan Airport Parking Deck Project on the Robie Parcel within the North Cargo Area (NCA) with the construction beginning in spring 2010. The NSA Roadway Corridor project will coordinate the NCA Logan Airport Parking Deck Project, East Boston-Chelsea Bypass Project, the SWSA Redevelopment Project, and the NSA Buffer Project to develop a unified utility, roadway, and landscape vision for the NSA roadway corridor between Prescott Street and Neptune Road. Massport has also begun planning for the East Boston-Chelsea Bypass Project, to develop a limited access roadway between Logan Airport and the new Chelsea Street Bridge. An ENF for this project is currently under review by the MEPA Office.

For the 2010 EDR, the Airport Planning chapter should describe the status of planning initiatives for the:

- Roadway Corridor Projects;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

I expect that this chapter will contain a comprehensive discussion about the coordination of parking efforts at Logan in light of the construction of the Parking Deck Project on the Robie Parcel, beyond what was presented in the 2009 EDR (or that such information will be presented elsewhere in the document). The discussion should include information on the use of the new Parking Deck (or a schedule for implementing use) and the corresponding changes in use (e.g., uses that have been shifted or eliminated) of other parking areas at Logan. I understand that data will also be available about parking patterns as a result of ongoing passenger surveys being undertaken by Massport and the results of these surveys should inform the discussions about airport-wide parking operations.

I also note that several of the projects described in the planning chapter of the 2009 EDR are designed, at least in part, to consolidate and direct airport-related traffic to centralized locations and to minimize airport-related traffic on external streets in adjacent neighborhoods. The 2010 EDR should report, to the extent possible, on the status and effectiveness of these cumulative efforts.

The EDR should also report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. Massport should continue to assess planning strategies for improving Logan Airport's operations and services in a, safe, secure, efficient, and environmentally sensitive manner.

Regional Transportation

In general, the 2009 EDR has met the requirements with respect to regional transportation issues. The directives in the ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2009 EDR has performed this task.

The chapter describes activity levels at New England's regional airports in 2009 and updates recent planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2009 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

The decreases in passenger traffic and aircraft operations at New England airports reflect national trends in the face of volatile fuel prices and a worsening global economy. Specifically, of the total number of air passengers utilizing New England's primary commercial service airports, including Logan Airport, decreased from 44.4 million in 2008 to 42 million in 2009. This represents a passenger traffic decline of 5.4 percent. In the region, activity levels as measured by the number of aircraft operations fell by 14.2 percent, from 1.21 million operations in 2008 to 1.03 million operations in 2009. In addition, air passenger traffic at the regional

airports in New England declined, as the challenging operating environment for airlines affected smaller communities disproportionately. Airlines introduced major reductions in operations throughout the year, eliminating less profitable routes and cutting frequencies in smaller markets. LCCs, such as Southwest Airlines and JetBlue Airways, also stopped expanding their operations at regional airports in recent years, and are now instead focusing on expansion in larger air service markets with a strong business travel portfolio.

Massport also reported in the 2009 EDR that there were continued negotiations with the City of Worcester to purchase Worcester Regional Airport. In June 2010, the City of Worcester transferred the airport to Massport for $17 million.

Massport should continue the directive from the ESPR Certificate for the 2010 EDR. In addition, for 2010 EDR the chapter on Regional Transportation should describe Logan Airport's role in the region's intercity transportation system by reporting on the following related to Regional Airports and Regional Transportation System:

Regional Airports

- 2010 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground Access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's efforts in strengthening the regional transportation system;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2009 EDR serves its purpose of updating 2009 ground access conditions on the airport, and has also adequately addresses the updating of the three new programs to support employees' use of alternative transportation options.

This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2009. Specifically, ground transportation activity levels associated with Logan Airport generally decreased for all surface transportation modes from 2008 to 2009 as a result of a 2.3 percent decline in the annual number of air passengers. The 2009 EDR reports that the average daily traffic on airport roadways decreased by 7 percent from 2008 to 2009, while vehicle miles traveled decreased by 5 percent.

Data in the 2009 EDR reports that Massachusetts Bay Transportation Authority (MBTA)

transit ridership to the Airport, including the Blue Line and the Silver Line, increased in 2009. Silver Line boardings at the Airport continued to grow, increasing by 11 percent in 2009 (compared to a 5 percent increase in 2008). In contrast, air passenger ridership on Logan Express bus, by water transportation, and by limousine decreased in 2009. From 2008 to 2009, Logan Express air passenger ridership decreased by 8 percent, ridership on water transportation decreased by 8 percent, limousine ridership decreased by 11 percent, and taxi dispatches decreased 7 percent. The 2009 EDR reports that over the past several years, transit services, including Logan Express, have experienced substantial increases in employee use. In 2009, employee use of Logan Express increased 4 percent over 2008 levels.

Despite improvements in use of the MBTA's Blue Line and Silver Line, the number of vehicles parked on-Airport increased by 11 percent in 2009 compared to 2008. The EDR states that Massport continued to comply with the Logan Airport Parking Freeze, and the document contained copies of Massport's bi-annual Parking Space Inventory reports that are submitted to the Massachusetts Department of Environmental Protection to document Massport's compliance with the Parking Freeze.

The 2010 EDR should continue to update 2010 ground access conditions on the airport and report on the use of the three new programs to support employees' use of alternative transportation options. The chapter should also report on 2010 conditions and provide a comparison of 2010 findings to those of 2009 for the following:

- Detailed description of compliance with the Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) membership and services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT). VMT will be calculated using the updated model created in 2004 that is based on the full build roadway network;
- Parking demand and management (including rates and duration statistics); and
- Ground access management strategy.

I am troubled by the increased demand for vehicle parking at Logan demonstrated by the 2009 data reported in the EDR, a concern that I understand is shared by Massport. Although Massport has already dedicated significant resources to encouraging transit use, the increased parking demand data suggest that greater efforts are warranted. The 2010 EDR should report on Massport's efforts in this regard. In addition, I expect that this will be a significant component of the long-range planning efforts Massport is currently undertaking.

Noise

The Noise Abatement chapter updates the status of the noise environment at Logan Airport in 2009, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main text provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The future 2010 EDR represents an appropriate forum to serve this updating function.

The decrease in the number of aircraft operations in 2009 resulted in changes in the noise environment. The 2009 Day-Night Sound Level (DNL) contours were smaller in many locations compared to 2008. The 65 dB DNL contour decreased in size in East Boston. The contour reduced in size over Winthrop and towards South Boston from Runway 27, but increased slightly north of the Airport over Revere due to an increase in departures from Runway 4R. The contour also increased south of the Airport over South Boston due to an increase in arrivals to Runways 4L and 4R. These changes are due to extended closings of Runway 9-27 for resurfacing in 2009.

In 2009 Massport completed installation of an improved Noise Monitoring System (NOMS). The Era Systems Corporation's (ERA) flight tracking system and all new noise monitors were operational in 2009. Combined with new noise monitor software, the system has an improved capability of correlating measured noise events with individual flight tracks.

The 2009 EDR reports that the overall number of people exposed to DNL values greater than 65 decibels (dB) decreased by 43 percent in 2009 compared to 2008. An estimated 4,335 people were exposed to DNL levels greater than 65 dB, as depicted in the 2009 contour, compared to 7,579 in 2008. This is the first time that the number of people exposed to the 65 dB noise level has been fewer than 5,000 since reporting this data in the EDR format. The total population exposed to noise levels greater than DNL 70 dB decreased from 249 in 2008 to 243 in 2009. There was a reduction of noise for 73 people in Winthrop but an increase of noise for 67 people exposed to greater than DNL 70 dB in Boston. The EDR reports that all of the residences exposed to DNL levels greater than 65 dB in 2009 that have chosen to participate in the soundproofing program have been sound-insulated by Massport. In 2009, Massport provided sound insulation to 83 homes, nearly half of which were in Chelsea. The focus of this program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's sound insulation program, 11,136 homes have been sound-insulated in East Boston, South Boston, Winthrop, Revere, and Chelsea.

The information in this chapter is very informative and I encourage Massport to continue this format in the 2010 EDR. I also strongly advise Massport to consider and address the comments received that have raised noise related concerns. Commenters have requested further explanation of the reasons for the increased use of Runway 33L for jet aircraft departures and corresponding decrease in use of Runway 27. The comments from the City of Cambridge, as well as from individuals such as Ms. Timmerman, P.E., have raised a number of concerns and

suggestions related to noise that Massport should incorporate into the 2010 EDR.

For 2010 the Noise Abatement chapter should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2010 conditions and compare 2010 conditions to those of 2009 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and any qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) compliance; and
- Flight tracks, including a discussion of the update on the Standard Terminal Automation Replacement System (STARS) radar and consolidation of the Boston Terminal Radar Approach Control (TRACON) at Merrimac, plus Massport's installation and use of PASSUR data.

The chapter should also report on 2010 conditions and compare those to 2009 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContours and RealProfiles, produce an accurate set of Day-Night Sound Level (DNL) noise contours. Adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain will be reported;
- Noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContours and RealProfiles;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The chapter should also report on noise abatement efforts and provide a status update on the new noise and operations monitoring system.

Air Quality

The Air Quality/Emissions Reduction chapter provides an overview of airport-related air quality issues in 2009 and efforts to reduce emissions. The modeled emissions inventory results were driven principally by the lower number of aircraft operations at the Airport compared to 2008, and continual refinements to the FAA Emissions and Dispersion Modeling System

(EDMS). The 2009 EDR reports that the total emissions of volatile organic compounds (VOC) were 980 kg/day, or 19 percent lower than 2008 levels. Total emissions of oxides of nitrogen (NOX) were 3,979 kg/day, or 5 percent lower than 2008 levels. In 2009, total NOx emissions at Logan Airport (net total with reductions) were approximately 746 tons per year (tpy) lower than the 1999 Massport's Air Quality Initiative (AQI) benchmark. This represents a 32 percent decrease in NOx emissions since 1999. Total emissions of carbon monoxide (CO) were 7,925 kg/day, or 5 percent lower than 2008 levels. Because of the refinements to the EDMS model and decreased air traffic, total emissions of particulate matter (PM) PM10/PM2.5 associated with operations at Logan Airport have decreased by approximately 12 percent to 71 kilograms per day (kg/day) compared to 2008 levels. By comparison, using the earlier EDMS v5.1 total emissions of PM10/PM2.5 would have decreased by approximately 2 percent to 79 kg/day. This variation is attributed to differences in the EDMS versions.

As part of the Section 61 findings for the centerfield taxiway component, the first phase of a two-phase Massport Air Quality Monitoring Study was initiated in September 2007 at ten locations on- and off-airport using both real time and time-integrated methods to measure fine particulates, volatile organic compounds (VOC), carbonyls, black carbon, and polynuclear aromatic hydrocarbons (PAHs). The 2009 EDR reports that since 1999 there has been a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the general vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2009 were well within the National Ambient Air Quality Standards (NAAQS) for NO2. The first phase of a two-phase Massport Air Quality Monitoring Study commenced in September 2007, and was completed September 2008, and a final report will be issued summarizing the findings. The study is collecting ambient data on a variety of air pollutants over a two-year period and will assess air quality changes attributable to the operation of the new centerfield taxiway. The second phase of the study will begin in September 2010 now that the centerfield taxiway is completed and fully operational.

Massport prepared an emission inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport. The 2009 GHG emission inventory has been updated incorporating guidance developed by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The ACRP guidance was published in April 2009 to be used by airport operators developing an airport specific GHG emissions inventory. While not including emissions from the cruise phase of flight above 3,000 feet, in a change from previous EDRs, the 2009 inventory assigns emissions based on ownership and control boundaries (i.e., emissions and sources associated with Massport, airport tenants and the general public). The vast majority of the emission sources at Logan Airport are owned or controlled by the airlines, other airport tenants, and passenger vehicles. Massport operations contribute only 11 percent of the total GHG emissions for the Airport. Total Logan Airport GHG emissions in 2009 were 14 percent lower than 2008 levels.

Massport has also made attempts to reduce aircraft emissions by working with the FAA to study and implement airfield-improvement concepts and operational changes that may have air quality benefits. Massport promoted such concepts through the Logan Airside Improvements Planning Project Environmental Impact Statement, which recommended physical and operational improvements to Logan Airport including construction of the new Runway 14-32 and centerfield taxiway, and other taxiway improvements. Runway 14-32 became operational in November 2006 and the centerfield taxiway was fully opened in summer 2009. In addition, in coordination with Massport, the Massachusetts Institute of Technology (MIT) completed a detailed survey of pilots at Logan Airport to better understand the use of single engine taxiing and issued a paper in March 2010 which was included in Appendix L. Commenters on the 2009 EDR have requested that Massport increase efforts to encourage the use of single engine taxiing. An update of these efforts should be reported in the 2010 EDR.

The 2010 EDR should continue updates on the information presented in the 2009 EDR and address comments received related to air quality. For 2010 the Air Quality/Emissions Reductions chapter should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should also discuss analysis methodologies and assumptions and report on 2010 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The chapter should also include:

- Emissions inventory for carbon monoxide (CO);
- Emissions inventory for oxides of nitrogen (NOx);
- Emissions inventory for volatile organic compounds (VOCs);
- Emissions inventory for particulate matter (PM);
- Nitrogen dioxide (NO2) monitoring; and
- NOx emissions by airline.

This chapter should also report on the following air quality initiatives (AQI) for 2010:

- Air Quality Initiative Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of other Logan Airport air quality studies undertaken by Massport or others.

The Air Quality Chapter should also include an inventory of GHG emissions from Logan Airport in 2010. GHG emissions should be quantified for aircraft, GSE, motor vehicles and stationary sources using emission factors and methodologies outlined in the Greenhouse Gas Emissions Policy and Protocol issued by EEA. The results of the 2010 GHG emissions inventory should be compared to the 2009 results.

Water Quality/Environmental Compliance

This chapter describes Massport's ongoing environmental management activities including NPDES compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. In accordance with the requirements of the current

NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants. The 2009 Annual Certificates of Compliance were submitted to the U.S. Environmental Protection Agency (EPA) and MassDEP on December 28, 2009, for Massport and each co-permittee.

In accordance with the Massachusetts Contingency Plan (MCP), the 2009 EDR reports that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2009 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities, where fleet and field maintenance activities are conducted, was on-going in 2009.

In 2009, there were six reportable oil and hazardous material spills detailed in the 2009 EDR. Massport received a Notice of Noncompliance (NON) from the MassDEP on September 18, 2009. The NON listed a total of 13 stormwater discharge samples that exceeded permit limits in the period since the NPDES permit was issued in July 2007. In response to the NON, Massport implemented corrective actions throughout the Airport directed at specific issues identified in the NON, as well as generally reviewing and updating standard practices at the Airport. One of the outfall samples out of a total of 72 samples at the Maverick Street Outfall exceeded the regulatory limits of the NPDES permit for the North, West and Maverick Street outfalls which was reported.

In accordance with the requirements of the NPDES permit for Logan Airport, Massport conducted a water quality study to evaluate the potential biological, chemical, and toxicological impacts of de-icer discharges on Boston Harbor. The study concluded that de-icer discharges do not negatively impact dissolved oxygen levels in the harbor, do not contain materials in concentrations over water quality criteria or toxicological benchmarks, and do not adversely affect the designated uses of the receiving waters.

For 2010 the Water Quality/Environmental Compliance and Management chapter should report on the 2010 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility
- Jet fuel usage and spills
- Massachusetts Contingency Plan (MCP) Activities
- Tank Management
- Update on the environmental management plan
- Fuel spill prevention

- Future stormwater management improvements (if any)
- Future MCP and tank management activities

Massport should continue to report in the 2010 EDR how Massport will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy, which articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision.

This chapter describes Massport's continued efforts including Massport-wide sustainability and details how sustainability is incorporated into many aspects of Massport's activities: Planning and Design; Construction; Operations, Maintenance and Management; and Monitoring of Environmental Performance which are detailed in this chapter. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2010 EDR.

The 2009 EDR outlines how Massport is committed to sustainable practices to help reduce impacts associated with construction. For example, Massport requires contractors to comply with construction guidelines regarding demolition waste recycling, soil reuse, and air emissions from construction equipment. In 2009, Massport undertook the 2010 Environmental Benchmarking Survey sponsored by Airport Council International North America (ACI-NA) to assess solar power, purchase of renewable energy, availability of low emission ground transportation, recycling and "green" purchasing.

The new Signature Flight Support GA Facility in the North Cargo Area, opened in 2007, the first LEED certified GA facility in the United States. This GA Facility at Logan Airport is serving as a model for new Signature Flight Support GA facilities around the U.S., including at Chicago O'Hare International Airport. The 2009 EDR also reports on the International Standards Organization (ISO) 14001 standard certification for Massport's Logan Airport Facilities II (vehicle maintenance, landscaping, and snow removal) that was completed in December 2006 and was recertified in December 2009. ISO Certification for Facilities I (Central Heating and Cooling Plant) and Facilities III (Electrical and Structural) is scheduled for 2010.
Massport began construction in 2010 on the new Consolidated Rental Car Facility (ConRAC). It will meet the Commonwealth of Massachusetts "LEED Plus" requirements and strive for LEED Silver level certification or better. The ConRAC will include the infrastructure necessary to accommodate future plug-in stations for electric vehicles and other alternative fuel sources such

as E-85 (ethanol). The ConRAC could accommodate car sharing services, such as ZipCar, at a later date. The ConRAC design includes pedestrian and bicycle accommodations including secure bicycle storage. The facility will include efficient water systems including water reclamation for vehicle wash water, and use of stormwater for non-potable uses such as vehicle washing and landscaping irrigation. At least 2.5 percent of the proposed program's overall electricity needs will be met with solar or wind power, or another form of renewable energy. Rental car companies have pledged to maintain rental car fleets which include hybrid or alternativefuel/ low-emitting vehicles.

In 2009, Massport began a four-year rehabilitation of the Terminal B parking garage, which includes the installation of solar panels on the top parking deck and high efficiency Light-Emitting-Diode (LED) lighting throughout the structure. The use of motion-detecting LED fixtures will use approximately 50 percent less electricity than the existing lighting, reducing existing usage by 2,261,218 killowatt-hours (kWhs) of electricity per year. This, along with other energy conservation measures, will reduce 1,307 metric tons of carbon dioxide (CO_2) the equivalent of not using 3,040 barrels of oil or 148,385 gallons of gasoline annually. The Airport expects a savings of $3.8 million in electrical usage over the next 20 years based on costs of $0.12 per kWh. Additionally, the installation of 16 solar panel trees is expected to produce 83,980 kWhs of electricity, or 2.5 percent of the total garage annual consumption. This is equal to the reduction of 50 metric tons of CO_2 the equivalent of not using 115 barrels of oil or 5,637 gallons of gasoline annually. Each solar panel is a single structure design with a stem and steel frame that uses solar panels as a roof over parked cars. The design has the added benefit of collecting rainwater that will be used for landscaping and cleaning projects on the Airport. Each solar array is mounted on an air ventilation unit on the roof of the garage and does not affect parking operations or the number or spaces available to travelers.

For 2010, this chapter should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported:

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Safety Improvements;
- Replacement Terminal A;
- The Consolidated Rental Car Facility; and
- Logan Airside Improvements Planning.

This chapter should also update the status of Massport's mitigation commitments and identify projects for which mitigation is complete.

Responses to Comments

The 2010 EDR must include Responses to Comments which addresses all of the substantive comments from the letters listed at the end of this Certificate. The Response to Comments included in this EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the next EDR, although the Responses to Comments should pay particular attention to increased specificity, where necessary.

The majority of comments received on the 2009 EDR focused on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the 2010 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commentors where appropriate.

Conclusion

I have determined that the 2009 EDR for Logan Airport has adequately compiled with MEPA and that Massport may prepare a 2010 EDR in lieu of a multi-year ESPR for submission in 2011.

November 12, 2010
Date

Ian A. Bowles

Comments Received:

11/04/10	Darryl Pomicter (email)
11/05/10	Nancy Timmerman
11/05/10	City of Cambridge, Executive Department
11/09/10	Jerome Falbo

IAB/ACC/acc

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December 16, 2011

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE 2010 LOGAN AIRPORT ENVIRONMENTAL DATA REPORT

PROJECT NAME	: 2010 Environmental Data Report
PROJECT MUNICIPALITY	: Boston and Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority (Massport)
DATE NOTICED IN MONITOR	: November 9, 2011

As Secretary of Executive Office of Energy and Environmental Affairs (EEA), I hereby determine that the Environmental Data Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62I) and with its implementing regulations (301 CMR 11.00).

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of Massport's long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific Environmental Impact Reports (EIR). The ESPR is generally updated on a five year basis, with much less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between

ESPRs. The 2010 EDR is the subject of this review. In addition, the Scope for the 2011 ESPR is provided in this Certificate.

In general, the EDR has fulfilled its purpose of providing a "snapshot" of 2010 passenger and impact levels at Logan Airport. Most environmental parameters showed improvement in calendar year 2010. In particular, the technical studies in the 2010 EDR included reporting on and analysis of key indicators of airport activity levels, airport planning, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. Mitigation commitments for noise impacts and air quality remain key concerns both of this office and the commenters, and are presented in the form of project-specific Section 61 Findings, as well as more general mitigation that has emerged from the ESPR process.

The majority of comments received on the EDR focused on noise issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2011 ESPR and future EDRs should also report on the progress and other refinements for tracking noise and abatement efforts, as further described in the Scope for the 2011 ESPR below.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

The last Logan ESPR was filed for calendar year 2004. However, due to the current economic downturn, as described in the 2008 and 2009 EDRs, activity levels at Logan Airport and associated environmental impacts continue to remain well below historic levels. Therefore it was anticipated that in 2010, near-term activity levels and associated environmental effects were also expected to remain well below levels previously analyzed for Logan Airport. Thus, the forecasted aviation growth presented in the 2004 ESPR, the predicate upon which the ESPR schedule was initially established, did not occurr. Therefore, I allowed Massport to prepare a 2010 EDR in lieu of the scheduled ESPR. Massport has prepared the 2010 EDR, which will be followed by a 2011 ESPR. Massport proposed a schedule for filing the next ESPR in light of observed and expected activity levels and any other changes in airport operations that have occurred since the 2004 ESPR was filed.

Review of the 2010 EDR and Scope for the 2011 ESPR

General

The 2011 ESPR should follow the general format of the 2004 ESPR, presenting major policy discussions and an overview of the role of Logan Airport in the regional planning context. This should be followed by a status report on Massport's planning initiatives, projects, and mitigation measures. The ESPR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

The 2011 ESPR should report on updated passenger and operations activity forecasts for Logan Airport and Massport's other airports, Hanscom Field and Worcester Regional Airport. The new forecast used should begin with 2011 as the base year and project activity forecasts forward to calendar year 2030. In addition, the 2011 ESPR should use the results of the 2010 Logan Airport Air Passenger Survey and the findings of the Sustainable Ground Access Strategy and Service Plan effort to inform future access planning.

The technical studies in the 2011 ESPR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2011 ESPR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2010 EDR.

A distribution list for the 2011 ESPR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The 2011 ESPR must include responses to comments that address all of the substantive comments from the letters listed at the end of this Certificate. The responses to comments included in the 2010 EDR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the 2011 ESPR.

The majority of comments received on the 2010 EDR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission

reduction issues. In addition to responding to these comments, the 2011 ESPR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This chapter presents aviation activity statistics for Logan Airport in 2010 and compares activity levels to the prior year, including air passengers, aircraft operations, fleet mix, and cargo/mail volumes.

There were a number of significant changes in activity at Logan Airport in 2010. The total number of air passengers at Logan Airport increased by 7.5 percent to 27.4 million, compared to 25.5 million in 2009. In comparison, between 2008 and 2009 the number of air passengers using Logan Airport declined by 2.3 percent. This is below the historic peak reached in 2007. Also the total number of aircraft flights grew from approximately 345,310 in 2009 to 352,640, an increase of 2.1 percent. This remains below the historic peak achieved in 1998. Passenger aircraft operations did, however, decrease by 1.6 percent compared to 2009 levels. Compared to a decline of 48.6 percent in 2009, general aviation (GA) operations increased 19.9 percent in 2010, particularly as businesses increased their travel and use of GA transportation as the economy transitioned. GA accounted for 4.2 percent of aircraft activity at Logan Airport in 2010. In addition, dedicated air cargo operations decreased by 5.8 percent compared to the previous year.

The EDR reflects data that shows that the number of air passengers per aircraft operation increased, from an average of 73.9 passengers per aircraft operation in 2009 to an average of 77.8 in 2010. While legacy air carriers continued to reduce the number of aircraft operations at Logan Airport, low-cost carrier (LCC) operations increased by approximately 40 percent in 2010. The increase in operations by LCCs, primarily JetBlue Airways and Southwest Airlines, accounted for nearly all of this growth. Even though the number of dedicated air cargo aircraft operations decreased in 2010, air cargo volumes increased from 546 million pounds in 2009 to 572 million pounds in 2010, an increase of 4.7 percent.

The 2011 ESPR must report on airport activity levels, including information on aircraft operations, including fleet mix, passenger activity levels, and cargo and mail operations. It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives over the next few years.

For the 2011 ESPR, the Activity Levels chapter should include:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;
- Passenger activity levels;

- Cargo and mail activities;
- Compare 2011 aircraft operations, cargo/mail operations, and passenger activity levels to 2010 activity levels; and
- Report on national aviation trends in 2011 and compare to trends at Logan Airport.

It should also report on Massport's forecasts that become the basis for the planning and impact sections that follow and for Massport's planning initiatives over the next five years. Future year analyses should be based on the 2030 forecast. It should update the aircraft operations and passenger activity forecasts, and provide a discussion of analysis methodologies and assumptions, including anticipated fleet mix changes and other trends in the aviation industry. It should also report on the following:

- Compare 2011 operations to historic trends (to 2000) and forecasts for planning horizon year 2030;
- Present updated forecasts of Logan Airport's passenger volume, aircraft operations, and fleet mix; and
- Compare forecast activity levels to historic trends, prior Logan Airport forecasts, and Federal Aviation Administration (FAA) forecasts for Logan Airport and the U.S. industry.

In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2010 EDR.

Planning

The Airport Planning chapter provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2010. It also describes known future planning, construction, and permitting activities. In 2010 Massport completed the permitting process for redeveloping the Southwest Service Area (SWSA), a new consolidated rental car facility (ConRAC). Construction of this project began in July 2010. In July 2009, the MEPA review process began for the Logan Runway Safety Area (RSA) Improvements Project at Runway Ends 33L and 22R. In July 2010, Massport filed a combined federal/state Draft EA/EIR and the Final EA/EIR on January 31, 2011. Construction of the Runway 33L RSA improvements commenced in June 2011. In 2010 MEPA review was completed on the Green Bus Depot, a bus maintenance facility for Massport's clean fuel fleet buses in the North Service Area (NSA). The Green Bus Depot will be used to maintain the expanded shuttle bus fleet that will replace the Airport's aging compressed natural gas (CNG) bus fleet and the rental car company diesel shuttle buses. Construction of this project began in 2011.

The 2010 EDR reports multiple projects in the planning and design phase. Planning for the East Boston-Chelsea Bypass project commenced to develop a limited access roadway between Logan Airport and the new Chelsea Street Bridge. The Bypass roadway is expected to improve commercial vehicle access to the Airport, as well as reduce congestion on local East

Boston streets in the vicinity of Day Square, Eagle Square, and the Neptune Road corridor by directing airport-related commercial traffic to the new Bypass roadway. Massport filed an ENF on October 15, 2010, for which I determined that no further MEPA review was required. Construction is underway as of 2011. Massport also initiated planning for the Logan Airport Parking Deck Project (Economy Garage) along Prescott Street in the North Cargo Area (NCA) in 2010. The project was not subject to MEPA review and construction of the economy garage began in summer of 2010 and was completed and fully opened to the public in early 2011. Massport installed solar panel "trees" on the roof of the parking deck, and energy-efficient lighting throughout.

In the 2010 EDR, Massport also discusses completing the North Service Area (NSA) Roadway Corridor Project with final landscaping in 2011, which is a project to unify the existing roadway with new landscape. Construction of the NSA Roadway Corridor Project also began in 2010. Architectural design also commenced in December 2010 for two hangar upgrades in the NCA. In addition, Terminal B Garage repair and rehabilitation continued in 2010 where 32 solar panel trees (200 kilowatt (kW)) were installed on the top floor and the entire garage was fitted with high efficiency Light-Emitting Diode (LED) lighting. Taxiway G realignment construction was completed in 2010.

The 2011 ESPR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport must accommodate and guide tenant development. The ESPR should describe the status of planning initiatives for the following areas:

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2011 ESPR should also indicate the status of long-range planning activities, including the status of public works projects implemented by other agencies within the boundaries of Logan Airport. The ESPR should also indicate the status and effectiveness of ground access changes, including roadway and parking projects, that consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on streets in adjacent neighborhoods.

Regional Transportation

In general, the 2010 EDR has met the requirements with respect to regional transportation issues. It describes activity levels at New England's regional airports in 2010 and updates recent

planning activities. Massport has demonstrated that it is coordinating its planning with other transportation agencies, and that this planning effort is aimed at minimizing cumulative impacts from Logan Airport operations. The 2010 EDR includes estimates of potential passenger diversions from Logan, and outlines how Massport planning encourages those diversions.

The total number of air passengers utilizing New England's commercial service airports, including Logan Airport, increased from 42.0 million in 2009 to 43.1 million annual air passengers, an increase of 2.5 percent in 2010. While Logan Airport passenger traffic grew, air passenger levels continued to decline at the other regional airports. Passenger levels at the regional airports declined by 5.2 percent in 2010, compared to an increase of 7.5 percent at Logan Airport. This was largely due to legacy carriers withdrawing from smaller secondary markets and reducing their use of small regional jets.

Aircraft operations in the New England region remained largely flat, increasing slightly by 0.7 percent, from 1.03 million operations in 2009 to 1.04 million operations in 2010. The 2010 EDR reports that commercial airline operations declined by 0.25 percent. General aviation and military flights increased by 1.9 percent and 4.7 percent respectively. For the 2011 ESPR, Massport should continue to engage in cooperative metropolitan planning efforts including GreenDOT and the Healthy Transportation Compact, and the Boston Metropolitan Planning Organization (Boston MPO).

The directives in the last ESPR Certificate were laid out to have Massport look at potential diversions, and explain how its planning and coordination with other agencies could impact potential diversions. The 2010 EDR has performed this task.

The 2011 ESPR should describe Logan Airport's role in the region's intercity transportation system by reporting on the following:

Regional Airports

- 2011 regional airport operations, passenger activity levels, and schedule data within a historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports, including the updated 2030 forecasts for both airports.

Regional Transportation System

- Overview of the restructured Massachusetts Department of Transportation (MassDOT) and Massport's role in managing regional transportation facilities;
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2010 EDR reported on 2010 ground access conditions at the airport. This chapter reports on transit ridership, roadways, traffic volumes, and parking for 2010. Specifically, the total number of annual air passengers at Logan Airport increased 7.5 percent to 27.4 million, compared to 25.5 million in 2009. During the same period, average daily traffic on airport roadways increased by 5.1 percent from 2009 to 2010, while vehicle miles traveled (VMT) at the Airport increased by 4.8 percent. The number of vehicles parked at the Airport increased by four percent from 2009 to 2010. As stated previously, Massport began construction of the Logan Airport Parking Deck Project, located on the 1,000-space Economy Lot in the NCA. It consolidates an additional 2,000 commercial parking spaces from various on-airport temporary commercial parking lots into a single structured parking facility containing approximately 3,000 commercial parking spaces. The garage maintains on-airport parking capacity in compliance with the limits imposed by the Logan Airport Parking Freeze. The garage was fully opened in March 2011.

Ground access activity to Logan Airport generally increased for all travel modes from 2009 to 2010. In 2010, Massport administered the periodic *Logan Airport Air Passenger Ground Access Survey* which indicates that mode shares for high-occupancy vehicles (HOV) to the Airport have returned to 2004 levels (30 percent HOV mode share) after having decreased by two percent in the *2007 Air Passenger Ground Access Survey*. MBTA Silver Line boardings at the Airport continued to grow, increasing by five percent in 2010, while Blue Line boardings at Airport Station decreased slightly compared to 2009. In 2010, ridership on water transportation to the Airport increased by about one percent in comparison to the previous year. Limousine ridership increased by an estimated 16 percent, and taxi dispatches increased 12 percent from 2009 to 2010. In 2010, Logan Express air passenger ridership increased by about one percent compared to 2009 levels, whereas employee use of Logan Express increased by four percent, and accounts for 42 percent of the service's ridership.

The 2011 ESPR should report on 2011 ground access conditions at the airport and provide a comparison of 2011 findings to those of 2010 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High-occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and

- Results of the 2010 Logan Airport Air Passenger Survey.

The chapter should present a discussion of analytical methodologies and assumptions for the planning horizon year (2030) for traffic volumes, on-airport vehicle miles traveled (VMT) and parking demand.

The 2011 ESPR should present a discussion of the following topics:

- Massport's target HOV mode share along with incentives;
- Non-Airport through-traffic;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line, Silver Line, Water Transportation, and Logan Express;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Progress on enhancing water transportation to and from Logan Airport;
- Progress on rental car consolidation;
- Report on results of ground access study; and
- Strategies for enhancing services and increasing employee membership in the Logan Airport TMA.

Noise

The EDR updates the status of the noise environment at Logan Airport in 2010, and describes Massport's efforts to reduce noise levels. The technical appendix contains useful and detailed information, while the main document provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The future 2011 ESPR represents an appropriate forum to serve this updating function.

The 2010 Day-Night Sound Level (DNL) contours are similar in size compared to 2009. The DNL 65 decibel (dB) contour remained the same in Revere and in most of Winthrop. The extent of the DNL 65 dB contour decreased slightly in the Point Shirley section of Winthrop due to the reduced number of departures from Runway 9 and the reduced number of aircraft arrivals over South Boston and East Boston. The geographic extent of the DNL 65 dB contour, however, did increase in East Boston near the Airport and over Boston Harbor due to an increase in departures from Runway 15R.

The 2010 EDR also reported on the findings of the Integrated Noise Model's (INM) results of the population impacted by airport noise and used both the 2010 and 2000 U.S. Census data as a basis for comparison. Using the 2000 Census, the overall number of people exposed to values greater than DNL 65 dB decreased by 11 percent in 2010, compared to 2009. An estimated 3,870 people were exposed to levels greater than DNL 65 dB as depicted in the 2010 contour, compared to 4,335 in 2009. This is the first time that the number of people exposed to the DNL 65 dB noise level has been fewer than 4,000 and that the number of people within the

DNL 65 dB in Boston has dropped below 1,000 to 711 people. Also the total population exposed to noise levels greater than DNL 70 dB decreased in 2010 compared to 2009. In 2009, the total population exposed to greater than DNL 70 dB was 243, and in 2010 the number dropped to 198.

The 2010 EDR also reports that in 2010, Massport provided sound insulation to 83 homes, nearly half of which are in Chelsea. The focus of this program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's Sound Insulation program, 11,219 homes have received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

The information in this chapter is very informative and I encourage Massport to continue with more detailed analysis in the 2011 ESPR. I strongly advise Massport to consider and address the comments received that have raised noise related concerns. The comments from the City of Cambridge, as well as from individuals have raised a number of concerns and suggestions related to noise that Massport should address into the 2011 ESPR.

The 2011 ESPR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, the methodologies used to track noise, and any changes in noise modeling. The chapter must report on 2011 conditions and compare 2011 conditions to those of 2010 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

The chapter must report on 2011 conditions and compare those to 2010 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM) produce an accurate set of Day-Night Sound Level (DNL) noise contours;
- Noise-impacted population (using the 2010 Census data);
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of most current version of the Integrated Noise Model (INM);
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The chapter should report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system. This chapter should also present a discussion of analysis methodologies and assumptions, including fleet mix and runway use assumptions, and report on future year conditions for 2030 for the following noise indicators:

- Runway utilization;
- DNL noise contours; and
- Population counts.

The chapter should also report on noise abatement efforts and provide a status update on any new noise and operations monitoring system. At the public meeting held on November 16, 2011, several residents of the Point of Pines section of Revere requested that their homes be included in Massport's Residential Sound Insulation Program (RSIP). As discussed at the public meeting and shown in the 2010 EDR, Point of Pines falls outside the 60 DNL contour, and, therefore, is ineligible for funding in the FAA's RSIP that begins at the 65 DNL contour. However, in response to a resident's and the City Council's request, Massport has already committed to conducting supplemental noise monitoring during 2012 in the Point of Pines area to validate the results of the permanent noise monitor (Carey Circle, #17) in that section of Revere. The results of that analysis should be reported in the 2011 ESPR.

Air Quality

The 2010 EDR provides an overview of airport-related air quality issues in 2010 and efforts to reduce emissions. The 2010 EDR reports that the total emissions of volatile organic compounds (VOC) were 1,019 kilograms per day (kg/day). This number is four percent higher than 2009 levels but is still following a long-term, downward trend decreasing by almost 78 percent since 1990. The increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2009. The total emissions of oxides of nitrogen (NOX) were 3,989 kg/day, or less than one percent higher than 2009 levels. In 2010, total NOx emissions at Logan Airport (net total with reductions) were approximately 742 tons per year (tpy) lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents a 32 percent decrease in NOx emissions since 1999. The total emissions of carbon monoxide (CO) were 7,160 kg/day, or 10 percent lower than 2009 levels. Due to the decreased use of No. 6 fuel oil, total emissions of particulate matter (PM) PM10/PM2.5 associated with Logan Airport heating and cooling decreased in 2010 by approximately 10 percent to 64 kg/day compared to 2009 levels.

The 2010 EDR reports that since 1999, there has been a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2010 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO2. The 2010 EDR

also reported on Massport's two-phased Air Quality Monitoring Study that is collecting data on a variety of ambient air pollutants over a two year period and assessing air quality changes attributable to the operation of the new centerfield taxiway. The second phase of the Study concluded in 2011, after the centerfield taxiway became fully operational. Massport will submit the findings from this study to MassDEP in late 2011 or early 2012. The results of this study should also be reported in the 2011 ESPR.

Massport prepared an inventory of greenhouse gas (GHG) emissions directly and indirectly associated with Logan Airport operations. The 2010 GHG emission inventory was updated incorporating guidance developed by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The ACRP guidance was published in April 2009 for airport operators to develop an airport-specific GHG emissions inventory. The 2010 inventory assigns emissions based on ownership or control (e.g., Massport, airlines and other airport tenants, and the general public). The vast majority of emission sources at Logan Airport are owned or controlled by the airlines, airport tenants, and the general public (through emissions from motor vehicles). According to the EDR, Massport sources contribute 12 percent of the total GHG emissions for the Airport. Total Logan Airport GHG emissions in 2010 were slightly lower (0.4 percent) than 2009 levels.

The 2011 ESPR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should also discuss analytical methodologies and assumptions and report on 2011 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The chapter should also include:

- Emissions inventory for carbon monoxide (CO);
- Emissions inventory for oxides of nitrogen (NOx);
- Emissions inventory for volatile organic compounds (VOCs);
- Emissions inventory for particulate matter (PM);
- Nitrogen dioxide (NO2) monitoring; and
- NOx emissions by airline.

This chapter must also report on the following air quality initiatives (AQI) for 2011:

- Air Quality Initiative Tracking;
- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

The 2011 ESPR should also include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2011. GHG emissions should be quantified for aircraft, motor vehicles and stationary sources using emission factors and methodologies outlined in the *Greenhouse Gas Emissions Policy and Protocol* issued by EEA and the Transportation Research Board's

Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06). The results of the 2011 GHG emissions inventory should be compared to the 2010 results.

The ESPR should also present a discussion of analytical methodologies and assumptions and report on future year condition for 2030 for the following air quality indicators:

- Emissions Inventory for CO;
- Emissions Inventory for NOx;
- Emissions Inventory for VOCs; and
- Emissions Inventory for GHGs.

In a comment letter from Mr. Pomicter, there is a request for a program to encourage the use of single-engine taxiing and suggested that Massport has not fulfilled its Section 61 mitigation commitments associated with the Logan Airside Improvements Project (EOEA #10458), specifically related to single-engine taxi procedures. The ESPR should include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions. I encourage Massport to communicate with airlines regarding the use of single engine taxiing, when safe to do so, within the Logan Airport operational context. An update of this effort should be provided in the 2011 ESPR.

The 2011 ESPR should also report on the status of the Logan Health Study, as requested by a commenter, which is currently underway by the Massachusetts Department of Public Health (DPH), portions of which were funded by Massport. This DPH study was initially fully funded by the Commonwealth, but was later cut by the legislature. Massport agreed to fund the shortfall for a total of $195,000. This sum was transferred to the Commonwealth/ DPH in December 2010 and that study is now progressing to completion. Massport should continue to provide data to DPH in support of this analysis. The commenter also questioned why the Commonwealth had not yet completed the legislated study of health effects of particulate air pollution (and specifically fine and ultrafine particulate matter) from surface and air transportation required by the Transportation Reform Act of 2009. Because there are presently no federal or state public health standards for ultrafine particulate matter, Massport committed to provide $150,000 to MassDOT in support of the scoping of the analyses called for in the Transportation Reform Act. The 2011 ESPR should provide more details on this commitment.

Water Quality/Environmental Compliance

The 2010 EDR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan, and tank management. In accordance with the requirements of the current NPDES permit for Logan Airport that was issued on July 31, 2007, Massport and all 27 co-permittees and tenants began preparation of an updated Stormwater Pollution Prevention Plan (SWPPP). Massport completed its SWPPP in December

of 2007 and tenant SWPPPs were completed in March 2008. Massport's SWPPP addresses stormwater pollutants in general, and also addresses deicing and anti-icing chemical, potential bacteria, fuel and oil, and other sources of stormwater pollutants.

In accordance with the Massachusetts Contingency Plan (MCP), the 2009 EDR reported that Massport continues to assess, remediate, and bring to regulatory closure areas of subsurface contamination. The 2010 EDR states that Massport is working towards achieving regulatory closure of the remaining MCP sites. In addition, preparation of the Environmental Management System (EMS) for facilities where fleet and field maintenance activities are conducted was on-going in 2010.

In 2010, there were 15 oil and hazardous material spills that required reporting to MassDEP, five of which involved a storm drainage system. One outfall sample out of a total of 19 samples at the Maverick Street Outfall and one outfall sample out of a total of 23 samples at the North Outfall exceeded the regulatory limits of the NPDES permit for the North, West, and Maverick Street Outfalls. The 2010 EDR reports that these exceedances were reported during April and November of 2010, respectively, as required. The 2010 Annual Certificates of Compliance were submitted to the U.S. Environmental Protection Agency (EPA) and MassDEP on December 21, 2010, for Massport and each tenant co-permittee.

The 2011 ESPR should report on the 2010 status of:

- NPDES Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- Massachusetts Contingency Plan (MCP) activities;
- Tank management;
- Update of the environmental management plan; and
- Fuel spill prevention.

The chapter should also present a discussion of the following topics:

- Future stormwater management improvements (if any) ; and
- Future MCP and tank management activities.

Massport should continue to report in the 2011 ESPR how it will assess, remediate, and bring to regulatory closure areas of subsurface contamination.

Sustainability at Logan Airport

This chapter describes Massport's airport-wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy that articulates Massport's commitment to protect the environment and to implement sustainable design

principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision. It also identifies the actions necessary to achieve the goals, the staff members responsible for each sustainability goal, and the timeline for achieving the goals. The short-term goals set out in the Sustainability Plan were described in the 2010 EDR. Massport participated in the 2010 Environmental Benchmarking Survey sponsored by Airports Council International-North America (ACI-NA) to assess solar power, purchase of renewable energy, availability of low-emission ground transportation, recycling, and environmentally preferred purchasing.

The EDR describes Massport's continued sustainability efforts and details how sustainability is incorporated into many aspects of Massport's activities. The information in this chapter is very informative and I encourage Massport to continue with its updates in the 2011 ESPR. The 2011 ESPR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have commenced construction. The mitigation commitments were made in the Section 61 Findings for the following projects which should be reported:

- West Garage/Central Garage;
- International Gateway;
- Runway Ends 22R and 33L Runway Safety Area Improvements;
- Replacement Terminal A;
- Logan Airside Improvements Planning; and
- Southwest Service Area Redevelopment Program.

The 2011 ESPR should also update the status of Massport's mitigation commitments and also identify projects for which mitigation measures have been completed.

Distribution of the 2011 ESPR

Several commenters have requested more timely filings of future EDRs and the forthcoming 2011 ESPR and other information related to the airport. Massport should explore opportunities to advance the reporting of information through Massport's website. Massport should strive to collect and analyze the information required for the 2011 ESPR and report this information in a timely manner. Many commenters have suggested ways to improve the text, maps and graphics and Massport should consider those changes for future filings. For several recent projects, Massport has published bi-lingual meeting and project notices and made the services of an interpreter available upon request. Massport should consider continuing these services for the 2011 ESPR and future EDR submittals.

Conclusion

I have determined that the 2010 EDR for Logan Airport has adequately complied with MEPA and that Massport must submit a 2011 ESPR that responds to the issues raised in

comments received. The 2011 ESPR must include a copy of this Certificate and a copy of each comment letter received on the 2010 EDR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues.

December 16, 2011
Date

for Richard K. Sullivan Jr.

Comments Received:

12/09/2011	Air, Inc.
12/09/2011	City of Cambridge, Executive Department
12/09/2011	Nancy Timmerman
12/09/2011	Stephen Kaiser, PhD
12/09/2011	Darryl Pomicter
12/15/2011	Boston Transportation Department
12/15/2011	The Boston Harbor Association
12/15/2011	City of Boston Environment Department

RKS/ACC/acc

The Commonwealth of Massachusetts

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June 14, 2013

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
2011 LOGAN AIRPORT ENVIRONMENTAL STATUS AND PLANNING REPORT

PROJECT NAME	: 2011 Environmental Status and Planning Report
PROJECT MUNICIPALITY	: Boston and Winthrop
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 3247
PROJECT PROPONENT	: Massachusetts Port Authority (Massport)
DATE NOTICED IN MONITOR	: April 24, 2013

As Secretary of Environmental Affairs, I hereby determine that the Environmental Status and Planning Report submitted on this project **adequately and properly complies** with the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and with its implementing regulations (301 CMR 11.00).

The environmental review process for Logan Airport has been structured to occur on two levels: airport-wide and project-specific. The Environmental Status and Planning Report (ESPR) has evolved from a largely retrospective status report on airport operations to a broader analysis that also provides a prospective assessment of long-range plans. It has thus become, consistent with the objectives of the MEPA regulations, part of Massport's long range planning. The ESPR provides a "big picture" analysis of environmental impacts associated with current and anticipated levels of activities, and presents an overall mitigation strategy aimed at avoiding increases in such impacts. The ESPR analysis is supplemented by (and ultimately incorporates) the detailed analyses and mitigation commitments of project-specific Environmental Impact Reports (EIR). The ESPR is generally updated on a five year basis, with much less detailed Environmental Data Reports (EDR) (formerly Annual Updates) filed in the years between ESPRs. The 2011 ESPR is the subject of this review. In addition, Massport has requested to combine the 2012-2013 EDRs into one document. I have considered and granted this request. This Certificate also contains a Scope for the 2012-2013 EDR.

In general, the ESPR has responded to the scope. In particular, the 2011 ESPR contains a wealth of useful data on activity levels and impacts, and lays out a forecast for trends in the future years. The technical studies in the 2011 ESPR include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2011 ESPR updates and compares the data presented in the 2010 EDR, and presents activity levels (including aircraft operations and passenger activity) and environmental conditions at Logan Airport for calendar year 2011. In addition to the annual report on 2011 conditions, two other primary functions of this 2011 ESPR are to provide a discussion of future activity levels at Logan Airport through the year 2030 based on an updated forecast, and to predict the associated potential environmental conditions at the Airport in 2030. The 2011 ESPR also presents historical data on the environmental conditions at Logan Airport dating back to 1990 in instances where historical information is available. Historical data are included in the technical appendices. Overall the 2011 ESPR provides a comprehensive, cumulative analysis of the effects of all Logan Airport activities based on actual and predicted passenger activity and aircraft operation levels in 2011 and 2030 and presents environmental management plans for addressing areas of environmental concern.

The majority of comments received on the 2011 ESPR focused on noise issues, including measurement of noise, modeling of noise contours, and noise abatement. In addition to responding to these comments, the 2012-2013 EDR should also report on the progress and other refinements for tracking noise and abatement efforts, as further described in the Scope below.

Background

In 1979, the Secretary of the Executive Office of Environmental Affairs issued a Certificate requiring Massport to define, evaluate, and disclose, every three years, the impact of long-term growth at the airport through a Generic Environmental Impact Report (GEIR). The Certificate also required the submission of interim Annual Updates to provide data on conditions for the years between the GEIRs. The GEIR provided projections of environmental conditions where the cumulative effects of individual projects could be understood. The Secretary's Certificate on the *1997 Annual Update* proposed a revised environmental review process for Logan Airport. As a result, Massport evaluates the cumulative impacts associated with airport activities through preparation of an ESPR every five years and provides data updates annually through the EDRs.

Review of the 2011 ESPR and Scope for the 2012-2013 EDR

Framework for the 2011 ESPR

Massport has adopted a new, long-term forecast for the long-range planning horizon,

2030. Previous forecasts for the 1999 ESPR and the 2004 ESPR forecasts anticipated that Logan Airport would be handling 37.5 million annual passengers in 2015 and 42.8 million passengers in 2020, respectively. The 2011 ESPR revisits previous forecasts and revises them based on current and predicted conditions, and to consider a more distant time horizon.

For this 2011 ESPR, Massport updated the Logan Airport long-range forecast with 2015, 2020, and 2030 as the forecast years. Three scenarios were also developed (Low, Moderate, and High). Massport views the Moderate forecast scenario as the most likely forecast of future activity levels at Logan Airport. Massport's forecast under the Moderate scenario predicts that there will be 39.8 million passengers using Logan Airport in 2030. The updated forecast takes into account slower-than-anticipated passenger growth (compared to previous forecasts), the increasing efficiency of aircraft (higher passenger load factors), and fleet mix trends, including a growing prevalence of larger capacity jet aircraft. This 2011 ESPR examines both airside and landside activities, including planned Massport projects, and projects being carried out by others that affect the Airport, such as the FAA's Boston Logan Airport Noise Study (BLANS). Future year projections incorporate available information about projects that have undergone or are currently under MEPA review.

Cumulative analysis of airport activities are based on actual and projected passenger activity levels, aircraft operations, and the facilities and services needed to serve them. Analysis conditions for current and future years are used to assess environmental conditions and to develop, evaluate, and adjust environmental management actions.

General

The 2012-2013 EDR should follow the general format of the 2010 EDR status report on Massport's planning initiatives, projects, and mitigation measures. The 2012-2013 EDR should include an Executive Summary and Introduction, similar to previous ESPRs and EDRs. Massport must provide necessary background information to allow reviewing agencies and the public to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

Specifically, the 2012-2013 EDR should provide an update on conditions at Logan Airport for calendar year 2012 and 2013. The EDR should continue to serve as a background/context against which projects at Logan Airport can be evaluated. It should also report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate.

The 2012-2013 EDR should report on 2012 and 2013 passenger and aircraft operation activity levels. This will be followed by a status report on Massport's proposed planning initiatives and projects and mitigation. In this way, Massport should provide the necessary background information to allow the reviewer to understand the environmental policies and

planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

The technical studies in the 2012-2013 EDR should include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, environmental management, and project mitigation tracking. The 2012-2013 EDR must also respond to those issues explicitly noted in this Certificate and the comments received on the 2011 ESPR.

A distribution list for the 2012-2013 EDR (indicating those receiving documents, CDs, or Notices of Availability) should be provided in the document. This section must also include copies of all ESPR and EDR Certificates issued since the 2004 Logan Environmental Status and Planning Report (issued on August 16, 2006) to provide context for reviewers. Supporting technical appendices should be provided as necessary.

Responses to Comments

The 2012-2013 EDR must include responses to comments that address all of the substantive comments from the letters listed at the end of this Certificate. The responses to comments included in the 2011 ESPR is well-constructed and cross-referenced. Massport may follow the same format in addressing comments in the 2012-2013 EDR.

The majority of comments received on the 2011 ESPR focus on noise related issues, including measurement of noise, modeling of noise contours, and noise abatement, and emission reduction issues. In addition to responding to these comments, the 2012-2013 EDR should continue to report on the refinements to noise tracking and abatement efforts. Massport should consult directly with individual commenters where appropriate.

Activity Levels

The Activity Levels chapter provides a solid analysis of major activity issues and the technical appendix contains useful and detailed information. This section in the 2011 ESPR specifically presents aviation activity statistics for Logan Airport in 2011 and compares activity levels to the prior year. The specific activity measures discussed include air passengers, aircraft operations, fleet mix, and cargo/mail volumes. This chapters also provides Massport's long-range 2030 aviation forecast for Logan Airport.

The 2012-2013 EDR must report on airport activity levels, including information on aircraft operations, including fleet mix, passenger activity levels, and cargo and mail operations. A primary purpose of this section of the 2012-2013 EDR will be to report on airport activity levels for 2012 and 2013, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport;

- Passenger activity levels;
- Cargo and mail activities;
- Compare 2012 and 2013 aircraft operations, cargo/mail operations, and passenger activity levels to 2011 activity levels; and
- Report on national aviation trends in 2012/2013 and compare to trends at Logan Airport.

It should also report on Massport's activity level forecasts that will become the basis for the planning and impact sections that follow and for Massport's strategic planning initiatives over the next few years. In addition to reporting the analysis of major activity issues, I advise Massport to consider and attempt to address all comments related to activity levels in the 2010 EDR.

Planning

The Airport Planning chapter in the 2011 ESPR provides an overview of planning, construction, and permitting activities that occurred at Logan Airport in 2011. It also describes known future planning, construction, and permitting activities and initiatives.

The 2012-2013 EDR should continue to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. Therefore, the 2012-2013 EDR should describe the status of planning initiatives for the following areas:

- Roadway Corridor Project;
- Airport Parking;
- Terminal Area;
- Airside Area;
- Service and Cargo Areas; and
- Airport Buffers and Landscaping.

The 2012-2013 EDR should continue to assess the status of long-range planning activities. The chapter should report on the status of public works projects implemented by other agencies within the boundaries of Logan Airport. The chapter will also report on the status and effectiveness of the ground access related changes including roadway and parking projects, which consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.

Regional Transportation

In general, the 2011 ESPR has met the requirements with respect to regional transportation issues. It describes activity levels at New England's regional airports in 2011 and updates recent regional planning activities.

Overall, aviation activity at New England's regional airports increased in 2011, because the regional airports experienced a modest recovery after the 2008/2009 Economic Recession. Highlights for the regional airports and the status of long-range regional transportation planning efforts in the region which are relevant to Massport's three airports as well as the regional transportation network are provided in the 2011 ESPR.

The 2012-2013 EDR should describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

Regional Airports

- 2012 and 2013 regional airport operations, passenger activity levels, and schedule data within an historical context;
- Status of plans and new improvements as provided by the regional airport authorities;
- Ground access improvements to the regional airports; and
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports.

Regional Transportation System

- Massport's role in managing the regional transportation facilities within the restructured Massachusetts Department of Transportation (MassDOT);
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations; and
- Report on metropolitan and regional rail initiatives and ridership.

Ground Transportation

The 2011 ESPR reported on transit ridership, roadways, traffic volumes and parking for 2011. It also provides forecasts for traffic volumes, parking, and VMT for the year 2030.

The 2012-2013 EDR should report on 2012 and 2013 conditions and provide a comparison of 2012 and 2013 findings to those of 2011 for the following:

- Detailed description of compliance with Logan Airport Parking Freeze;
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express);
- Logan Airport Employee Transportation Management Association (Logan TMA) services;
- Logan Airport gateway volumes;
- On-airport traffic volumes;
- On-airport vehicle miles traveled (VMT);
- Parking demand and management (including rates and duration statistics);
- Status of long-range ground access management strategy planning; and

- Results of the 2013 Logan Airport Passenger Survey.

The 2012-2013 EDR should also present a discussion of the following topics:

- Definition of HOV;
- Massport's target HOV mode share along with incentives;
- Non-Airport through-traffic;
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line;
- Report on Logan Express usage and efforts to increase capacity and usage;
- Progress on enhancing water transportation to and from Logan Airport;
- Progress on rental car consolidation;
- Report on results of ground access study; and
- Strategies for enhancing services and increasing employee membership in the Logan Airport TMA.

Noise

The 2011 ESPR updates the status of the noise environment at Logan Airport in 2011, and describes Massport's efforts to reduce noise levels. It also provides noise contour population counts for 2030. The technical appendix contains useful and detailed information, while the main document provides a solid analysis of major noise issues. Many of the issues raised in the noise analysis are ongoing and require continuous monitoring. The future 2012-2013 EDR represents an appropriate forum to serve this updating function and to address the noise issues raised by numerous commenters on the 2011 ESPR.

In 2011 the following changes occurred in the Airport noise environment:

- Compared to 2010, the 2011 DNL decibel (dB) contours were smaller in East Boston and over Boston Harbor toward Hull. The DNL 65 dB contour was slightly larger in Revere, South Boston, and in most of Winthrop for 2011.
- The overall number of people exposed to DNL values greater than 65 dB increased to 3,947 people in 2011 from 3,830 people in 2010 (an increase of 117 people). The number of people residing within the DNL 70 dB contour remained at 130 people. These levels are well below the numbers of people exposed in the year 2000 when 17,745 people were exposed to DNL noise levels greater than 65 dB and 1,551 people were exposed to DNL levels greater than 70 dB.
- In 2011, Massport provided sound insulation to 114 homes, 84 percent of which were in Chelsea. The focus of the program in Chelsea was to fulfill federal and state mitigation commitments related to the opening of Runway 14-32. Since the inception of Massport's residential sound insulation program (RSIP), 11,333 homes have received sound insulation treatment in East Boston, South Boston, Winthrop, Revere, and Chelsea.

Based on the 2030 forecast of aircraft operations and expected aircraft fleet mix, the following conditions are expected in 2030:

- There is forecast to be a larger number of operations and a higher percent of jet fleet activity than in 2011. The higher level of operations is not a capacity challenge as the Airport has operated in the past with over 1,300 operations per day.
- The 2030 fleet mix consists of 81 percent commercial jets whereas the 2011 fleet mix consists of 78 percent commercial jets. The 2000 fleet mix had a lower proportion of commercial jets at 62 percent of the fleet.
- Total operations are expected to increase by 29 percent or 290 operations per day from 2011 to 2030, from 1,011 operations per day in 2011 to 1,301 operations per day in 2030. Compared to 2000, which is the last year that Logan Airport had over 1,300 daily operations, 2030 is forecasted to have 54 fewer daily operations (1,355 in 2000 and 1,301 in 2030). Daytime commercial operations are projected to increase by 254 operations per day from 819 in 2011 to 1,073 in 2030, however this is still fewer than the 1,142 daytime operations in 2000. Nighttime commercial operations are projected to increase from 114 in 2011 to 154 in 2030. This is an increase compared to 2000 when 126 daily operations occurred at night.
- The 2030 operations forecast produced a larger set of DNL noise contours with the number of people exposed to noise levels greater than DNL 65 dB increasing from 3,947 in 2011 to 12,211 people in 2030. This is still significantly fewer than the number of people exposed in 2000 (17,745 people). The number of people within the DNL 70 dB is also projected to increase from 130 in 2011 to 352 people in 2030 but still remaining well below the 1,551 people within the DNL 70 dB in 2000. All of the residences within the forecasted 2030 DNL 65 dB contour are in areas where Massport has implemented its sound insulation program.

The information in this chapter is very informative and I encourage Massport to continue with detailed analysis in the 2012-2013 EDR. I strongly advise Massport to consider and address the comments on noise and noise related issues.

The 2012-2013 EDR should provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter should report on 2012 and 2013 conditions and compare those conditions to those of 2011 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft;
- Nighttime operations;
- Runway utilization (report on aircraft and airline adherence with runway utilization goals);
- Preferential runway advisory system (PRAS) tracking; and
- Flight tracks.

The 2012-2013 EDR should also report on 2012 and 2013 conditions and compare those to 2011 conditions for the following noise indicators:

- Using the Federal Aviation Administration's (FAA) most current version of the Integrated Noise Model (INM), and RealContoursTM and RealProfilesTM, produce an accurate set of Day-Night Sound Level (DNL) noise contours. Adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain will be reported;
- Noise-impacted population;
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the use of RealContoursTM and RealProfilesTM;
- Cumulative Noise Index (CNI);
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels;
- Installation and benefits of the new noise monitoring system; and
- Flight track monitoring noise quarterly reports.

The 2012-2013 EDR should also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the new noise and operations monitoring system.

Air Quality

The 2011 ESPR provides an overview of airport-related air quality issues in 2011 and efforts to reduce emissions. It also predicts emission levels for 2030. Overall total volatile organic compounds (VOC) emissions were 1,109 kilograms per day (kg/day), or 9 percent higher than 2010 levels, but still follow a long-range (i.e., a period of over 20 years) downward trend decreasing by almost 76 percent since 1990. This one-year increase is primarily due to the increase in landing and takeoff operations (LTOs) when compared to 2010 (176,322 LTOs in 2010 and 184,494 LTOs in 2011). Total emissions of oxides of nitrogen (NOX) were 4,077 kg/day, or 2 percent higher than 2010 levels. In 2011, total NOx emissions at Logan Airport were approximately 29 percent lower than 2000 levels. Also, total NOx emissions in 2011 were 707 tons per year (tpy) lower than Massport's 1999 Air Quality Initiative (AQI) benchmark. This represents an overall decrease of 30 percent in NOx emissions since 1999. Total emissions of carbon monoxide (CO) were 6,919 kg/day, or 3 percent lower than 2010 levels and 53 percent lower than 2000 levels; following the same long-range downward trend as VOCs and NOx. Total emissions of particulate matter (PM10/PM2.5) associated with Logan Airport increased in 2011 by approximately 5 percent to 67 kg/day compared to 2010 levels, but still following a long-range downward trend decreasing by 19 percent since 2005 (2005 is the first year that PM10/PM2.5 emissions were reported). This one-year increase is mostly attributable to the corresponding increase in stationary source use, particularly snow melters in conjunction with the unusually heavy snowfall in early 2011.

Since 1999, there has been a continuing trend of decreasing nitrogen dioxide (NO2) concentrations at both the Massport and Massachusetts Department of Environmental Protection (MassDEP) monitoring sites located in the vicinity of Logan Airport. In addition, the annual NO2 concentrations at all monitoring locations in 2011 continued to be well within the National Ambient Air Quality Standards (NAAQS) for NO2. The NO2 monitoring program was discontinued in 2012. Massport's Air Quality Monitoring Study is now complete, having collected data on a variety of ambient air pollutants over a two-year period as a means of assessing any air quality changes attributable to the operation of the Centerfield Taxiway which was completed in 2009. The findings from this Study will be submitted to MassDEP in 2013, and reported in the next Logan Airport EDR.

2011 marks the fifth consecutive year in which Massport has voluntarily prepared a greenhouse gas (GHG) emissions inventory for the EDR/ESPR. The 2011 GHG emission inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP). The 2011 inventory assigns GHG emissions based on ownership or control (whether it is controlled by Massport, the airlines or other airport tenants, or the general public). Total Logan Airport GHG emissions in 2011 were 5 percent higher than 2010 levels primarily due to the increase in aircraft operations and passenger vehicles accessing the Airport. Massport-related emissions represent only 12 percent of total GHG emissions at the Airport, tenant-based emissions represent approximately 68 percent, electrical consumption represents 14 percent; and passenger vehicle emissions represent 6 percent. This inventory is one of the three GHG emissions inventories Massport prepares annually; however, the other two only comprise stationary sources of GHGs and are filed with MassDEP and the U.S. Environmental Protection Agency (EPA) respectively.

The 2012-2013 EDR should include an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter should provide discussion on progress on the national and international levels to decrease air emissions to provide context for this chapter. The chapter will also discuss analysis methodologies and assumptions and report on 2012 and 2013 conditions using the most recent versions of the Emissions Dispersion Modeling System (EDMS) and MOBILE motor vehicle emissions. The 2012-2013 EDR should include:

- Emissions inventory for carbon monoxide (CO)
- Emissions inventory for oxides of nitrogen (NOx)
- Emissions inventory for volatile organic compounds (VOCs)
- Emissions inventory for particulate matter (PM)
- Nitrogen dioxide (NO2) monitoring
- NOx emissions by airline

The 2012-2013 EDR should also report on the following air quality initiatives (AQI) for 2012 and 2013:

- Air Quality Initiative Tracking;

- Massport's and Tenant's Alternative Fuel Vehicle Programs; and
- The status of Logan Airport air quality studies undertaken by Massport or others, as available.

Massport has also committed to include an inventory of greenhouse gas (GHG) emissions from Logan Airport in 2012 and 2013. GHG emissions should be quantified for aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission factors and methodologies outlined in the MEPA Greenhouse Gas Emissions Policy and Protocol. The results of the 2012 and 2013 GHG emissions inventory should be compared to the 2011 results. This chapter should also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions.

Water Quality/Environmental Compliance

The 2011 ESPR describes Massport's ongoing environmental management activities including National Pollutant Discharge Elimination System (NPDES) compliance, stormwater, fuel spills, activities under the Massachusetts Contingency Plan (MCP), and tank management.

The 2012-2013 EDR should report on the 2012/2013 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility;
- Jet fuel usage and spills;
- Massachusetts Contingency Plan (MCP) Activities;
- Tank management;
- Update on the environmental management plan; and
- Fuel spill prevention.

The chapter should also present a discussion of the following topics:

- Future stormwater management improvements (if any); and
- Future MCP and tank management activities.

Sustainability at Logan Airport

This chapter describes Massport's airport-wide sustainability goals. In October 2000, the Massport Board approved an Authority-wide Environmental Management Policy that articulates Massport's commitment to protect the environment and to implement sustainable design principles. In October 2004, the Massport Sustainability Team produced the *Massachusetts Port Authority Sustainability Plan* (Sustainability Plan). The Environmental Management Policy is incorporated in the Sustainability Plan as Massport's long-term sustainability goal or vision. It also identifies the actions necessary to achieve the goals, the staff members responsible for each sustainability goal, and the timeline for achieving the goals.

The 2012-2013 EDR should report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review and other commitments and have commenced construction. The status of mitigation commitments made in the Section 61 Findings for the following projects should also be reported:

- West Garage/Central Garage
- International Gateway
- Runway Ends 22R and 33L Runway Safety Area Improvements
- Replacement Terminal A
- Logan Airside Improvements Planning
- Southwest Service Area Redevelopment Program

This chapter should also update the status of Massport's mitigation commitments and also will identify projects for which mitigation is complete.

Distribution of the 2012-2013 EDR

Massport should explore opportunities to advance the reporting of information through Massport's website. Massport should strive to collect and analyze the information required for the 2012-2013 EDR and report this information in a timely manner. For several recent projects, including the 2011 ESPR, Massport has published bi-lingual meeting and project notices and made the services of an interpreter available upon request. Massport should consider continuing these services for the 2012-2013 EDR submittal.

Conclusion

I have determined that the 2011 ESPR for Logan Airport has adequately complied with MEPA and that Massport must submit a 2012-2013 EDR that responds to the issues raised in comments received. The 2012-2013 EDR must include a copy of this Certificate and a copy of each comment letter received on the 2011 ESPR. In particular, Massport should provide a thorough examination of issues raised regarding individual noise monitoring locations, noise measurement and modeling, noise abatement, and air quality issues.

June 14, 2013
Date

Richard K. Sullivan Jr.

Comments Received:

06/06/2013	Philip Johenning
06/07/2013	Nancy Timmerman
06/07/2013	Stephen Kaiser, PhD
06/07/2013	Darryl Pomicter
06/07/2013	Town of Milton
06/14/2013	The Boston Harbor Association

RKS/ACC/acc

B

Comment Letters and Responses

- The six comment letters received by the Massachusetts Environmental Policy Act (MEPA) Office on the *2012/2013 Environmental Data Report (EDR)* are reprinted here in the order shown below. As requested in the Secretary of the Executive Office of Energy and Environmental Affairs' Certificate, Massport has provided responses to substantive comments raised in the following letters:
  - Cindy L. Christiansen, PhD., Town of Milton resident
  - Frank J. Ciano, Town of Arlington Citizen Advisory Committee representative
  - Suzanne K. Condon, Associate Commissioner; Director, Bureau of Environmental Health
  - Joseph A. Curtatone, Mayor, City of Somerville
  - Vivien Li, President, The Boston Harbor Association
  - Nancy S. Timmerman, P.E., consultant in Acoustics and Noise Control

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January 26, 2015

The Honorable Maeve Vallely Bartlett, Secretary
Executive Office of Energy and Environmental Affairs
Attn: MEP A Office
Anne Canaday, EEA No. 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: Comments to Boston-Logan International Airport 201212013 Environmental Data Report (201212013 EDR), EOEA #3247

The Town of Milton appreciates the efforts to inform communities of Boston Logan International Airport's activities and environmental conditions through the 2012 Environmental Data report. Milton, a 13.5 square miles town south of Logan, is one of the most heavily burdened communities as the 2011 Environmental Status and Planning Report and this current EDR show. There are two departure RNAV paths (R27 and R33L), one RNAV arrival path (4R) and soon to be a second (4L) over our mostly residential community. These concentrated paths direct jets and turboprops over all of our six public school buildings, over the numerous private schools in our town, and our parks, sometimes for four or five days in a row with only a five hour break from the planes during the nighttime hours. Cunningham Park, where many families spend much of their summer time, is directly under the R4R RNAV that was implemented by the FAA in December 2011.

Although there are responses to comments from our May 28, 2013 letter regarding the 2011 Environmental Status and Planning Report, several have not received the attention they deserve.

1. This EDR, as in the 2011 ESPR, fails to acknowledge that Milton is an Affected Neighborhood for 27 Departures. Planes using the 27 RNAV disturb our residents greatly as they fly at low altitudes over the southwest neighborhoods of Milton. Residents report, using information from MASSPORT responses to noise complaints that most are at altitudes of 5,000-6,000 feet and still on their departure climb. Runway 27 departures begin around 5 a.m. and often these neighborhood wake-up jets begin five hours from when the 4R/4L arrivals stop the day before. Ending a day at midnight with low-flying jet arrivals over Milton and then beginning the next day at 5 a.m. with low-flying jet departures over Milton is unacceptable and shows complete disregard for our residents' health and well-being.

We disagree with the response that Milton is not a directly affected town from departing runway 27. B1

2. Runway 4L currently uses a visual approach over Milton, MA. We learned that the FAA in coordination with JetBlue has been testing a visual RNAV for Runway 4L approaches. The parallel runways 4R and 4L are approximately 1,400 feet apart. Construction of new parallel runways cannot, by law, be built this close together today. The lack of separation, the overuse of these runways, and their common use when there are strong crosswinds sets up the likelihood of a catastrophic event over Milton. We have witnessed numerous turn-arounds when the 4R

and 4L runways are used simultaneously. The FAA has saturated the skies over Milton. These turn-arounds and near-misses are warnings that catastrophic events likely will occur.
While the 33L RNAV EA was in litigation another RNAV over Milton was being tested. The 4L RNAV test did not include the cumulative impact of 33L (along with 4R arrivals and 27 departures) which overflies our town. However, the FAA claims "The implementation of this action will not result in any extraordinary circumstances in accordance with Order 1050.1E. See attached Initial Environmental Review dated June 25, 2013 for additional information." (See Appendix 2) The 33L RNAV EA also did not account for cumulative effects of another RNAV (4L) being implemented in the same town where 33L overflies. B2

3. We recently learned through local news and our own research that BOS Logan International Airport is preparing one of its terminals for A380 Operations. The A380 is a super jumbo jet, the largest jet currently made. The use of the A380 by several airlines with service to and from Boston has been reported in several newspaper and online articles. The 4-engine 560 ton jet has a wing span slightly less than a football field and holds up to 555 passengers. This soon will be flying over densely populated residential areas in our town of Milton, MA which has over 50,000 arrivals per year that are at about 2,000 feet in altitude when over our residents. The use of the A380 super jumbo jet at Logan is significant new information relevant to environmental concerns and bears on the entire runway use at Logan. The potential for catastrophic results are amplified because of the overuse of 4R runway for arrivals and the 27 runway for departures, all of which fly over Milton, saturating our skies with noise and pollution. B3
4. Our citizens report a pattern of non-compliance to FAA standards by the jets that overfly Milton. In the EA for the 33L RNAV the 33L flightpath designates the planes to fly to CBEAR waypoint before turning south. Many planes do not follow the designated flightpath and turn before CBEAR thus flying at lower altitude over Milton. Similarly to the non-compliance with the 33L RNAV, approaches to runway 4R over Milton typically are lower than the 4R RNAV standard. For example, at the MILTT waypoint, the standard altitude for arrivals is 1700 feet. However, according to information received from MASSPORT at Logan airport, the planes using the 4R RNAV are at 1,250 feet, on average, at MILTT. We request that MASSPORT provide non-compliance statistics based on its radar data that is used to calculate DNL estimates in this report. We also request comparisons of MASSPORT DNL estimates to that of the FAA when the REAL CONTOURS software is not used. B4
5. Two years ago we asked that these reports include a measure of the impression of the DNL estimates (or the margin of error at the typical 95% confidence). The response was this was "noted". We respectfully request, again, that this be added to the reports. We believe the DNL estimates could be off by as much as 5 dB from information we received from a MASSPORT document referenced in the 33L EA. B5
6. The May 2014 study by Hudda, et.al. of ultrafine particle counts as far as ten miles from the heavily used arrival runways at LAX indicate a concern for the amount of ultrafine particles residents of Milton are exposed to due to the heavily used 4R and 4L arrival runways. We understand that ultrafine particles currently are not regulated, but cell and animal studies indicate exposure to these particles likely have substantial negative health effects. We ask that

MASSPORT conduct measure studies of ultrafine particle counts along the 4R and 4L RNAV paths when in use for arrivals. B6

7. MASSPORT's response encourages Milton to compare itself to Lynn with respect to actual DNL measures from the noise monitors because the monitor in Lynn is under the 22L arrival path. However, Lynn is not listed as an "affected neighborhood" for 22L arrivals in Table 6-12 on page 6-49 of the report. Although the measured DNL for Lynn's monitor is 0.3 higher than Milton's, MASSPORT cannot say with any level of certainty that Lynn's noise burden is higher than Milton's. It also is perplexing why the difference between the measured and model DNL estimates for Lynn are very similar whereas for Milton, the differences are as high as 5.9 dB (page 6-44). We would appreciate an explanation for this. Also, when assessing the "time-above" table on page 6-52, we question why the DNL estimates for Lynn and Milton are so similar but the time-above 65 dB for Milton is about double that for Lynn. Please explain. B7
8. We continue to note the unfair runway use distribution for arrivals. MASSPORT reports NE winds approximately 18% of the time and southeast winds about 17% of the time. However, runways 4R/4L arrivals receive almost 40% of the jet arrivals but 15R, what should be the runway of choice with SE winds, only receives about 1% of the arrivals. How is this equitable or fair and what will MASSPORT do to fix this inequity of noise and air pollution burden forced onto our town? B8
9. The non-jet arrivals and departures over Milton also are excessive. Our community is very concerned about the pollution from these low-flying planes from their use of leaded fuel. As the flight track maps in the report show, our community receives a substantial percentage of these flights too. We ask that MASSPORT conduct studies of lead poisoning in communities under these flight paths. B9
10. These increases in measures of noise burden for Milton residents--compared to the decrease in many areas closer to Logan--is consistent with the increasing number of individuals in our Town who report that the airplane noise wakes them and their family members (including children), interrupts their conversations, and interferes with the peaceful enjoyment of their home. B10

Cindy L Christiansen

Digitally signed by Cindy L Christiansen
DN: cn=Cindy L Christiansen, o=Milton, MA 02186, ou=59 Collamore Street, email=clchristiansen@gmail.com, c=US
Date: 2015.01.26 18:42:18 -05'00'

Cindy L. Christiansen, PhD
59 Collamore St.
Milton, MA 02186
cLcMilton@gmail.com

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Comment #	Author	Topic	Comment	Response
B.1	Cindy L Christiansen, PhD Town of Milton Resident	General	We disagree with the response that Milton is not a directly affected town from departing Runway 27.	This question was asked previously and responded to in the *2012/2013 Environmental Data Report (EDR)* (please see comment B2 in the *2012/2013 EDR*). Runway 27 departures do pass over Milton and several other communities to the west and south of the Airport. The communities identified in Table 6-12 in the *2012/2013 EDR* are directly under the immediate arrival or departure path. Please note, that in response to the initial comment, Massport modified Table 6-12 in the *2012/2013 EDR* to add broader geographic areas.
B.2	Cindy L Christiansen, PhD Town of Milton Resident	Operations	The 33L RNAV EA also did not account for cumulative effects of another RNAV (4L) being implemented in the same town where 33L overflies.	The Federal Aviation Administration (FAA) prepared the Runway 33L RNAV Environmental Assessment and a Record of Decision (ROD) was issued. It is Massport's understanding that this process is complete.
B.3	Cindy L Christiansen, PhD Town of Milton Resident	Noise	The use of the A380 super jumbo jet at Logan is significant new information relevant to environmental concerns and bears on the entire runway use at Logan Airport.	Logan Airport is a major international airport and accommodates all types of aircraft in use by commercial air carriers. The EDR/ESPR analyses evaluate noise-related impacts of all aircraft, which would include the Airbus A380 if and when these aircraft begin regular service at Logan Airport. The A380 meets Stage 4 noise standards, which is the quietest noise standard for aircraft available today.
B.4	Cindy L Christiansen, PhD Town of Milton Resident	Noise	We request that Massport provide non-compliance statistics based on its radar data that is used to calculate DNL estimates in this report. We also request comparisons of Massport DNL estimates to that of the FAA when the Real Contours software is not used.	The *2014 EDR* noise analysis uses the latest version of the FAA's approved Integrated Noise Model (INM). Detailed information is provided in Appendix H, *Noise Abatement.* Massport utilizes actual radar flight tracks as input to the INM model.

Comment #	Author	Topic	Comment	Response
B.5	Cindy L Christiansen, PhD Town of Milton Resident	Noise	Two years ago we asked that these reports include a measure of the impression of the DNL estimates (or the margin of error at the typical 95% confidence) [and] we respectfully request, again, that this be added to the reports.	Massport follows FAA and industry accepted standards for noise data analysis and publishes the findings in the EDRs and ESPRs.
B.6	Cindy L Christiansen, PhD Town of Milton Resident	Air Quality	We ask that Massport conduct measure studies of ultrafine particle counts along the 4R and 4L RNAV paths when in use for arrivals.	Massport reports on pollutants (and their precursors) for which there are National Ambient Air Quality Standards (NAAQS) established by the U.S. Environmental Protection Agency (EPA). These NAAQS are set for carbon monoxide (CO), lead (Pb), nitrogen oxides (NO_2), ozone (O_3), particulate matter (PM_{10}, $PM_{2.5}$), and sulfur dioxide (SO_2). Presently, there are no U.S. EPA or Massachusetts air quality standards for ultrafine particulates (UFP). However, as this is an emerging topic, future ESPRs/EDRs will report on the findings of UFP studies related to aircraft emissions and near airports as they develop – including the one at Los Angeles International Airport (LAX).

Comment #	Author	Topic	Comment	Response
B.7	Cindy L Christiansen, PhD Town of Milton Resident	Noise	We would appreciate an explanation for [discrepencies between the measured and modeled DNL estimates for Milton]. Also, when assessing the "time-above" table on page 6-52, we question why the DNL estimates for Lynn and Milton are so similar but the time-above 65 dB for Milton is about double that for Lynn. Please explain.	In 2013, the Milton monitor and the Lynn monitor captured a similar number of events, however more events at the Lynn monitor are at night resulting in a higher measured DNL value. For the modeling, the Milton monitor experienced higher levels of arrivals (to Runway 4L/4R) than the Lynn monitor (to Runway 22L), however the Lynn monitor experienced higher arrivals during the night time period. The Lynn monitor, also experiences arrival overflights to other runways such as Runway 27. This results in a modeled value similar to the Milton monitor from a lower level of flights (due to the addition of 10 dB to nighttime events). The higher level of arrivals over the Milton monitor results in the higher 24-hour Time Above level than at the Lynn monitor since this is based on the number of modeled events above 65 dB.
B.8	Cindy L Christiansen, PhD Town of Milton Resident	Air Quality	How is [current runway use distribution for arrivals] equitable or fair and what will Massport do to fix this inequity of noise and air pollution burden forced onto our town?	Massport is currently undertaking a runway use study with FAA and the Citizens Advisory Committee (CAC), of which Milton is an active member. The FAA makes the determination of which runways to use. A goal of the current runway use study is to provide the FAA guidance on runway use selection with the goal of reducing persistent use of runways.

Comment #	Author	Topic	Comment	Response
B.9	Cindy L Christiansen, PhD Town of Milton Resident	Air Quality	We ask that Massport conduct studies of lead poisoning in communities under these flight paths.	In 2013, only 0.004% of the fuel dispensed at Logan Airport was 100LL (i.e., low lead avgas). Moreover, the vast majority of this fuel is burned "in-route" and at altitude away from Logan Airport and neighboring communities – further minimizing the potential ground-level impacts and exposures. The U.S. EPA is completing a comprehensive study of airborne lead concentrations at 15 airports with the greatest leaded fuel use in the U.S. The initial results from this study indicate that the measured lead levels in the vicinities of these airports were well within the National Ambient Air Quality Standards for this pollutant – with only one exception. The exception was at a California general aviation airport where one lead monitor was located in the airport's restricted area adjacent to a stockade fence and roughly 20 meters from the aircraft run-up zone. Another nearby monitor at the same airport had much lower levels.
B.10	Cindy L Christiansen, PhD Town of Milton Resident	Noise	These increases in measures of noise burden for Milton residents - compared to the decrease in many areas closer to Logan - is consistent with the increasing number of individuals in our Town who report that the airplane noise wakes them and their family members (including children), interrupts their conversations, and interferes with the peaceful enjoyment of their home.	Since 2000, aircraft-related noise levels have been significantly reduced for all surrounding communities. Additionally, the total number of aircraft operations has decreased. Massport is actively working with FAA and the CAC on a runway use study to further assess aircraft noise.

COMMENT VIA EMAIL

From: frankiecboy@aol.com [mailto:frankiecboy@aol.com]

Sent: Wednesday, January 14, 2015 3:32 PM

To: Canaday, Anne (EEA)

Cc: myronkassaraba@gmail.com; smbyrne1987@gmail.com; jcurro@alumni.tufts.edu;

achapdelaine@town.arlington.ma.us

Subject: Massport Environmental Data Report of 12/10/14

Hon. Matthew A. Beaton,

I SERVE AS THE ARLINGTON REPRESENTATIVE TO THE CAC AND MY PERSONAL OFFICE ADDRESS IS 230 MSGR. OBRIEN HWY., CAMBRIDGE, MA. I WRITE YOU AS THE CAC REPRESENTATIVE AND SPEAK FOR MYSELF ALONE IN THAT CAPACITY. CONGRATULATIONS ON YOUR APPOINTMENT.

ARLINGTON HAD BEEN UNAFFECTED BY THE OPERATIONS OF MASSPORT, LOGAN, UNTIL THE FAA PUT INTO EFFECT THE RNAV SYSTEM IN JUNE 2013. CONTRARY TO THE EXPECTATIONS GIVEN ALL BY THE FAA, NAMELY THAT THERE WOULD BE NO ADVERSE EFFECT, ARLINGTON RESIDENTS IN EAST ARLINGTON HAVE BEEN DISTURBED TO THE POINT OF UTTER FRUSTRATION BY THE NOISE AND VIBRATION SOMETIMES EVERY 15 MINUTES OVER A 24HR PERIOD, FROM APPRX. 6/13 TO DATE.

THIS PROBLEM I HAVE LEARNED, IS FROM THE USE OF RUNWAY 33L AND THE BASICALLY SINGLE LANE ROUTES NOW IN EFFECT BY THE FAA. IN THE PAST THE ROUTES WERE DISBURSED AND NOW UNDER THE RNAV SYSTEM, THE ROUTES ARE BASICALLY ONE LANE ROUTES.

THIS NEW SYSTEM SHOULD NOT ADVERSELY AFFECT A COMMUNITY AS IT HAS AND IN SOME CASES 15% OFLOGAN FLIGHTS ARE OVER ARLINGTON AND THIS HAS RESULTED IN 258 CALLS OF COMPLAINTS FROM ARLINGTON IN 2014. IN PRIOR YEARS OF 2012 THERE WERE NO COMPLAINTS AND IN 2013, 6 COMPLAINTS.

THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) PROVIDES THAT NO COMMUNITYSHOULD BE ADVERSELY IMPACTED BY PROCESS OUTCOMES AS HAS OCCURED IN THIS CASE. ON 1/13/15, I CONVEYED THE SUBSTANCE OF THE ABOVE AT THE PUBLIC HEARING AT MASSPORT.

WE SEEK YOU ASSISTANCE IN OUR EFFORT TO OBTAIN RELIEF FROM THE FAA. C1
WE, THANK YOU IN ADVANCE.
FRANK J. CIANO

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Comment #	Author	Topic	Comment	Response
C.1	Frank J. Ciano Town of Arlington CAC Representative	Noise	We seek your assistance in our effort to obtain relief from the FAA.	As reported in the *2012/2013 EDR*, Massport is participating in an FAA aircraft noise study as part of the Airside Improvement Project mitigation. The Logan Airport Community Advisory Committee (CAC), in which Arlington is an active member is also participating in this study. The primary focus of the Boston Logan Airport Noise Study (BLANS) is to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency. The study is being completed in three phases. Phases 1 and 2 are complete. The current Phase 3 of the BLANS is focusing on the development of an updated Runway Use Program. The findings of this study will be reported in future EDRs and ESPRs.

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The Commonwealth of Massachusetts
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Department of Public Health
Bureau of Environmental Health
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CHARLES D. BAKER
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KARYN E. POLITO
Lieutenant Governor

MARYLOU SUDDERS
Secretary

EILEEN M. SULLIVAN
Acting Commissioner

Tel: 617-624-6000
www.mass.gov/dph

January 26, 2015

The Honorable Matthew A. Beaton, Secretary Executive Office of
Energy and Environmental Affairs
Attn: MEPA Office
Anne Canaday, EEA No. 3247 100 Cambridge
Street, Suite 900
Boston, MA 02114

Dear Secretary Beaton:

The purpose of this letter is to provide comments on the Boston-Logan International Airport 2012/2013 Logan Airport Environmental Data Report (2012/2013 EDR). As stated on page 7- 38, the Massachusetts Department of Public Health released the final report of the Logan Airport Health Study (LAHS) in May 2014. The 201 2/2013 EDR acknowledges Massport's collaboration in providing important data to support the air dispersion modeling that was conducted as part of this effort. It also notes that Massport is working with DPH to implement the recommendations in the report. Much of this work involves funding by Massport for community health centers located in the high exposure area to enhance efforts to address respiratory health outcomes in children and adults living in closest proximity to the airport.

The 2012/2013 EDR summarizes Massport's initiatives to date to reduce air po11ution impacts within their control (e.g., providing infrastructure for compressed natural gas (CNG) fuels and electricity charging stations, Alternative Fuel Vehicle Program). The LAHS recommended additional initiatives to reduce air pollution impacts could be considered by Massport in consultation with local communities that would serve to further reduce the burden of indoor and outdoor sources of air pollution on residents in closest proximity to the airport. While there have been significant reductions in total air pollution emissions since 1990, we believe that such initiatives are important given that the 2012/2013 EDR indicates that total emissions have not fluctuated significantly since 2009.

The results of the air dispersion modeling performed for the LAHS suggest that the most productive ambient air quality mitigation activities at Logan Airport should focus on ground- level sources and on emissions that occur at the terminal complex. Massport has implemented several mitigation strategies that address these areas including converting fleet vehicles to Compressed Natural Gas and encouraging "front line" taxi pool privileges to hybrid taxis.

Additional conversion of APUs and other ground equipment to alternative fuels or electricity will also reduce emissions. Massport should also continue to evaluate comprehensive emission reduction strategies that target reduction of total emissions including strategies to reduce motor vehicle traffic congestion at the airport, reduce passenger vehicles to and from the airport by expanded use of public transit, incentivizing the use of low emission vehicles and alternatives to diesel vehicles, and optimizing the operation of equipment at reduced emissions rates. D1

We also recommend that Massport consider the significant body of research conducted by the Partnership for Air Transportation, Noise, and Emission Reductions (PARTNER). PARTNER is a cooperative aviation research organization, and an FAA/NASA/Transport Canada-sponsored Center of Excellence. The research is conducted locally by the Massachusetts Institute of Technology (MIT) and Boston University School of Public Health[1]. For example, numerous studies have focused on exposure and health implications of aviation-related emissions, including characterizing roadway and aircraft contributions to ultrafine particle concentrations at airports.[2,3] In addition, PARTNER has studied opportunities to enhance fuel efficiency and reduce emissions with initiatives aimed at improving air traffic efficiency.[4] Below are suggested edits using track changes to section describing the LAHS on page 7-38. D2

Massachusetts Department of Public Health Study

This study was completed in May 2014 and consists of an epidemiological health survey combined with computer modeling of noise levels and air pollution concentrations. The overall goal of the Logan Airport Health Study (LAHS) was to determine whether residents living in areas with greater potential for airport-related exposures were more likely to experience respiratory, cardiovascular, or auditory effects compared to those residents living in areas with lesser potential for airport-related exposures. Massport has cooperated in this effort by providing funding to complete the study and Airport operational data in support of it. In the spring of 2011, Massport also gave technical assistance in support of the DPH study by providing geographic information systems (GIS) analysis of the road way network in and around Logan Airport in a format compatible with the FAA's EDMS. Massport is working with DPH on implementing DPH recommendations related to Massport. D3

1 http://partner.mit.edu/projects/health-impacts-aviation-related-air-pollutants

2 Hsu, HH, Adamkiewicz G, Houseman EA, Vallarino J, Melly SJ, Wayson RL, Spengler JD, Levy JI. 2012. The Relationship Between Aviation Activities and Ultrafine Particulate Matter Concentrations Near a Mid-Sized Airport. Atmospheric Environment 50: 328-337.

3 Hsu HH, Adamkiewicz G, Houseman EA, Zarubiak D, Spengler JD, Levy JI. 2013. Contributions Of Aircraft Arrivals And Departures To Ultrafine Particle Counts Near Los Angeles International Airport. Sci Total Environ. 2013 Feb 1;444:347-55.

4 Aircraft Impacts on Local and Regional Air Quality in the United States Partnership for AiR Transportation Noise And Emissions Reduction Project 15 Final Report http://web.mit.edu/aeroastro/pattner/reports/proj 15/proj15finalreport.pdf

We hope these comments are helpful to you. We look forward to continuing our work with EOEEA, Massport, and residents of LAHS communities to enhance mitigation efforts. Please contact us at 617-624-5757 if you have any questions.

Sincerely,

Suzanne K. Condon, Associate Commissioner
Director, Bureau of Environmental Health

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Comment #	Author	Topic	Comment	Response
D.1	Suzanne K Condon Associate Commisioner, Director, Bureau of Environmental Health	Air Quality	Logan Airport should focus on ground-level sources and on emissions that occur at the terminal complex. Massport should also continue to evaluate comprehensive emission reduction strategies that target reduction of total emissions including strategies to reduce motor vehicle traffic congestion at the airport, reduce passenger vehicles to and from the airport by expanded use of public transit, incentivizing the use of low emission vehicles and alternatives to diesel vehicles, and optimizing the operation of equipment at reduced emissions rates.	Massport is committed to maintaining and advancing its programs and strategies aimed at reducing emissions of the U.S. EPA “criteria” pollutants (and their precursors) and greenhouse gases. These initiatives include providing both incentives and infrastructure that enable Massport, the Logan Airport tenants, and the public to participate in meaningful ways. Future EDRs and ESPRs will continue to report on the achievements and provide updates to the future plans of these emission-reduction measures.
D.2	Suzanne K Condon Associate Commisioner, Director, Bureau of Environmental Health	Air Quality	We also recommend that Massport consider the significant body of research conducted by the Partnership for Air Transportation, Noise, and Emission Reductions (PARTNER).	Massport is aware of the PARTNER research, the Airport Cooperative Research Program (ACRP) program as well as the research conducted by other local universities on air quality, health effects, and emission reductions as they pertain to airports. In some cases, Massport provides the researchers with supporting information and data for this research and will continue to do so to help advance what is known about these important and emerging topics. In other cases, Massport reviews the outcomes of the research and applies the information wherever possible.
D.3	Suzanne K Condon Associate Commisioner, Director, Bureau of Environmental Health	General	Below are suggested edits using track changes to section describing the LAHS on page 7-38: "The overall goal of the Logan Airport Health Study (LAHS) was to determine whether residents living in areas with greater potential for airport-related exposures were more likely to experience respiratory, cardiovascular, or auditory effects compared to those resients living in areas with lesser potential for airport-related exposures."	Comment noted. Massport has provided both financial and technical assistance as a means of advancing and completing the LAHS. Work is also underway by Massport to implement the recommendations contained in the report. Progress on this work will be reported upon in the next EDRs.

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CITY OF SOMERVILLE, MASSACHUSETTS
JOSEPH A. CURTATONE
MAYOR

January 26, 2015

Secretary Matthew Beaton
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
Analyst Anne Canaday, EEA No. 3247
Cambridge Street, Suite 900
Boston, MA 02114

RE: Boston Logan International Airport 2012/2013 Environmental Data Report: EEA# 3247

Dear Secretary Beaton:

The City of Somerville has reviewed the Boston Logan International Airport 2012/2013 Environmental Data Report (EDR) submitted by Massport and provides the following comments.

Noise: Request for Noise Monitor and an analysis of increased Somerville complaints

There are several locations in the Greater Boston area including Somerville's neighbor, Medford, where there are permanent noise monitors operated by Massport. Somerville does not have permanent noise monitors located within the city even though the Gate that services runway 15R is serviced via both communities almost equally. Additionally, there has been a noticeable increase in recorded complaints. In 2011 there were 98 complaints by 45 callers, in 2012 there were 95 complaints by 26 callers and in 2013 there were 166 complaints by 72 callers. So there is an increase of 71 complaints in 2013 compared to 2012 and an increase of callers by 46 for the same period. The complaints from City of Somerville residents are increasing, both from more callers and more complaints. The City of Somerville requests 1) a determination as to why complaints are increasing, and 2) the installation of one or more permanent noise monitors. E1

CITY HALL • 93 HIGHLAND AVENUE • SOMERVILLE, MASSACHUSETTS 02143
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E-mail: mayor@somervillema.gov

Air Quality: Request for public transportation Air Quality Impact Analysis in Somerville

The 2012/2013 EDR measures air quality in terms of localized ground operations at the airport. It also addresses Greenhouse Gas (GHG) emissions from these operations. Somerville Air Quality is affected due to mobile sources, primarily vehicles passing through Somerville to access the airport. Impact of public transportation in terms of private vehicle reductions passing through Somerville to Logan would provide some understanding or air quality impact on Somerville due to Logan Airport. E2

For these reasons, the City of Somerville requests that additional Somerville specific data be provided as part of the Boston Logan International Airport 2012/2013 Environmental Data Report to address the increase in Somerville complaints regarding noise. E3

Thank you for the opportunity to provide comment on this proposed project. Please contact my office with any questions.

Sincerely,

~~Joseph~~ A. Curtatone
Mayor

Comment #	Author	Topic	Comment	Response
E.1	Joseph A Curtatone Mayor of City of Somerville	Noise	The Cty of Somerville requests 1) a determination as to why complaints are increasing, and 2) the installation of one or more permanent noise monitors.	It is Massport's understanding that noise complaints are increasing due a combination of factors including weather conditions as well as additional concentration of flight tracks associated with the implementation of the FAA's Runway 33L RNAV procedures. Regarding the installation of permanent noise monitors, Massport has installed a network of permanent noise monitors based on the flight paths to/from Logan Airport. In order to capture the most accurate readings, noise monitors must be in locations directly under the main flight paths. This results in the greatest correlation between measured and modeled noise levels. The annual noise analysis conducted by Massport in the EDR follows the accepted industry standard protocols for capturing noise impacts on communities.
E.2	Joseph A Curtatone Mayor of City of Somerville	Air Quality	Request for public transportation Air Quality Impact Analysis in Somerville. Somerville Air Quality is affected due to mobile sources, primarily vehicles passing through Somerville to access the Airport. Impact of public transportation in terms of private vehicle reductions passing through Somerville to Logan would provide some understanding of air quality impact on Somerville due to Logan Airport.	While airport-related motor vehicle traffic traveling through Somerville likely accounts for some of the emissions in this airshed, it is unlikely that these emissions represent a significant portion compared to the overall total. Local and regional motor vehicle traffic and their emissions are expected to far outweigh the airport component. It is also noteworthy that a Health Study conducted by the Massachusetts Department of Public Health, designed to assess the potential effects of Logan Airport emissions on nearby communities, identified Somerville in the "low-to-medium" category (i.e., among the lowest possible ratings). The Logan Airport Health Study is available online at: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/investigations/logan-airport-health-study.html
E.3	Joseph A Curtatone Mayor of City of Somerville	Noise	The City of Somerville requests that additional Somerville specific data be provided as part of the Boston Logan International Airport *2012/2013 Environmental Data Report* to address the increase in Somerville complaints regarding noise.	Noise modeling includes all actual flight paths including those over the City of Somerville. These are reported in the EDRs and ESPRs.

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27 January 2015

Secretary Matthew Beaton
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114
ATT: MEPA Office

RE: EOEA No. 3247- 2012/2013 Environmental Data Report
Boston-Logan International Airport, Boston

Dear Secretary Beaton:

The Boston Harbor Association, a non-profit, public interest organization founded in 1973 by the League of Women Voters and the Boston Shipping Association to promote a clean, alive, and accessible Boston Harbor, is in receipt of the Boston-Logan International Airport 2012/2013 Environmental Data Report. This report focuses on cumulative environmental impacts of Logan Airport's operations and activities. Since 1989, Massport, owner and operator of Logan Airport, has been required to submit 5-year Environmental Status and Planning Reports and annual Environmental Data Reports so that the cumulative environmental effects of individual projects can be considered in a broader planning context.

Passenger usage of Logan Airport increased to 30.2 million passengers in 2013, a record high. During the same period, the number of aircraft operations fell from 368,987 in 2011 to 361,339 in 2013. This was a result of greater airline efficiency, with the average number of passengers going from 78.3 per aircraft operation in 2011 to an average of 83.6 passengers in 2013. Air cargo volumes dropped from 562 million pounds in 2011 to 558 million pounds in 2013.

The Boston Harbor Association has commented over the past decade on both the 5-year Environmental Status and Planning Reports as well as the annual Environmental Data Reports. Our comments on the 2012/2013 Report follow:

<u>Environmental Sustainability</u>: As noted in the prior report as well as the current 2012/2013 Environmental Data Report, Massport's continued efforts on environmental sustainability have been recognized by numerous organizations. The new Green Bus Depot uses renewable energy from solar panels, houses a hybrid-powered bus fleet, and incorporates water conservation measures. Likewise, the Rental Car Center which opened in 2013 includes water reclamation in its vehicle washing, uses renewable energy (wind and solar), and has plug-in stations for electric vehicles. We commend these green buildings and sustainable measures.

As part of climate change mitigation/environmental sustainability efforts, Massport has also actively worked to promote mass transit usage by airport passengers. 2013 ground access mode share of passengers indicate that 71.2% took some form of automobile, with 43% driving themselves (Table 5-1, Environmental Data Report). Approximately 29% of passengers accessed the airport by shared ride/HOV modes in 2013, with 15% using mass transit on weekdays (12.1% transit usage on weekends).

During this reporting period, Massport initiated free Silver Line Airport service at the airport, which we strongly support. Silver Line usage by airport passengers ranged from 3.5% on weekends to 5.1% on weekdays in 2013. Given the level of Massport subsidy, we urge greater marketing of the free Silver Line service to South Boston and to South Station in an effort to further reduce automobile usage. F1

We commend Massport for launching the new Logan Express bus service serving Back Bay hotels and Back Bay residents to the airport in 2014, and for coordinating with the MBTA to allow usage of the MBTA's Charlie Card on the new service. We are also very supportive of the multi-ride Logan Express ticket books at $75 for ten rides from Peabody, Woburn, Framingham, and Braintree. Initiatives like these make mass transit usage much more attractive.

At the same time, however, Table 5-9 of the Environmental Data Report (page 5-19) documents a steady increase in parking spaces from 2012 to 2014. Logan Airport is subject to a parking freeze, which is an element of the Massachusetts State Implementation Plan under the Federal Clean Air Act. Parking spaces at the airport totaled 20,692 in 2012, increased to 20,938 spaces in 2013, and peaked at 21,088 spaces in 2014. Creative counting of parking spaces under the category "Restricted Use Parking Spaces" is allowed ten days a year during peak air travel periods, and such spaces must be provided free of charge. Providing free parking does not seem consistent with efforts to reduce vehicular miles traveled and required reductions in air quality emissions. Consistent with the Massachusetts State Implementation Plan, we support efforts to discourage automobile usage, and strongly urge that "Restricted Use Parking Spaces" currently provided free of charge be eliminated. F2

The 2012-2013 Environmental Data Report further notes, "As noted above, however, demand for on-Airport parking in the terminal area is not price sensitive and these parking rate increases have so far failed to dampen parking demand" (page 5-24). While parking rates at the airport's central parking garage were raised $3 and $2, respectively, in 2012 and in 2014, the rates are still comparatively low compared to commercial parking rates in downtown Boston. Twenty-four hour parking at the central parking garage costs $29, and only $20 per day at the economy parking garage. Consistent with the goals of the State Implementation Plan under the Federal Clean Air Act, we support continued, significant parking rate increases to discourage automobile usage and to generate funds to further help subsidize transit options. F3

Water Transportation: The 2012/2013 Environmental Data Report notes, "Water transportation accounts for less than 1 percent of the mode share to Logan Airport, according to the 2013 Logan Airport Air Passenger Ground Access Survey. Annual ridership on privately-provided water transportation experienced an increase of over 16 percent in 2013 compared to 2012 and an increase of 3 percent in 2012 compared to 2011" (page 5-31). The report notes that during the reporting period there were three providers of water transportation to the airport: City Water Taxi, Rowes Wharf Water Shuttle, and the MBTA's Harbor Express.

Footnotes state that MBTA ferry service from Quincy/Hull to Logan was not as frequent as Blue Line and Silver Line services, does not run on frequent and consistent headways throughout the day, and was significantly more expensive than other public transportation (Footnote 13, page 5-31). These factors may help explain the drop in MBTA ferry usage from a high of 37,861 passengers in 2009 to 31,197 passengers in 2012 (Table 5-13). During the same period, though, private water taxi usage increased significantly, from a low of 50,734 passengers in 2009 to 58,879 passengers in 2011, 60,840 passengers in 2012, and a high of 70,378 passengers in 2013.

Subsequent to the reporting period, the water transportation providers changed in 2014, with Boston Harbor Cruises, a fourth-generation water transportation company, now operating the services formerly provided by City Water Taxi and Harbor Express. Given the new but highly experienced operator now at the airport, we believe it would be timely for Massport to convene a meeting of water transportation operators, municipal officials, and advocates to discuss water transportation routes, fare structures, and marketing. Such a meeting should focus on short-term service (in the next 1-3 years), and long-term service taking into account expansion of the Boston Convention and Exhibition Center, opening of Wynn Everett casino, and the Boston 2024 Olympic bid. We believe that there are opportunities to better serve water transportation users beyond just the one percent of passengers who currently use water transportation to the airport. F4

Open Spaces/Airport Buffer Areas/Resource Areas: Massport does an outstanding job of constructing and maintaining exceptional open spaces and Airport Buffer Areas. Summer 2014, Massport completed the East Boston Greenway Connector, an important connection between Bremen Street Park and an overlook at Wood Island Marsh linking Piers Park almost to Constitution Beach. It is a spectacular connection, advocated in 2009 by the Boston Conservation Commission, local residents, environmental organizations, and elected officials as part of the environmental commitments for the Logan Green Bus Depot. The Massport board approved the Connector project in 2011, and construction finally started in 2013. For all future projects, we ask that the Environmental Secretary require that the environmental commitment/mitigation be completed by the time of the issuance of a certificate of occupancy so that there is not a multi-year delay between project completion and completion of the environmental commitment/mitigation. F5

Consistent with the City of Boston's 2014 Climate Action Plan, we ask that the Secretary require Massport's Logan Airport projects to be consistent with the City's goal of increasing the urban tree canopy by 35%. There have been several airport projects where tree and/or vegetation removal have been deemed necessary. We ask that the Secretary reinforce that tree removal should be avoided. In the event that tree removal cannot be avoided, the replacement ratio used by the Boston Conservation Commission (2:1 or 3:1 replacement ratio) would be a useful one to implement. Such tree replacement should occur in the immediate area of Logan Airport, including open spaces and Airport Buffer Areas and/or in the abutting neighborhoods and communities of East Boston and Winthrop. F6

The Logan Airport Runway Safety Area Improvement Program caused a significant loss of eelgrass area (66,600 sq. ft. of eelgrass beds). The Secretary's Certificate called for a 3:1 replacement ratio. The eelgrass was transplanted in Boston Harbor in 2011, but did not survive through 2012. An alternative mitigation plan was devised, which called for conservation moorings on the North Shore and Cape Cod. Members of the Boston Conservation Commission as well as The Boston Harbor Association strongly supported having the mitigation in the same watershed area (Boston Harbor) adversely impacted by the airport project. We urge that the Secretary's Certificate require that any future mitigation measures required of Logan Airport projects be located in the same watershed area where the adverse impacts will occur. F7

Water Quality: Massport continues to make progress on water quality issues. In 2012, 132 oil spills occurred at the airport, of which 5 were of 10 or more gallons (593 gallons spilled into Boston Harbor during the year). In 2013, there were 94 oil spills, of which 6 were of 10 or more gallons (452 gallons spilled into Boston Harbor). It appears that a number of these spills were the result of aircraft fueling, and highlights the importance of working with the airlines and/or their vendors to ensure compliance with water quality standards through spill prevention.

We continue to urge that Massport identify additional "snow farm" locations so that there is not a need to request permission to lift the ban on snow dumping into Boston Harbor except potentially during blizzards when there may be insufficient locations to handle snow from airport runways. In rare blizzard circumstances where there may not be sufficient "snow farm" locations, only "clean" snow with no chemicals, salt, sand, or deicing materials should be allowed into Boston Harbor, and only after permission has been granted by the MA Department of Environmental Protection and the local Conservation Commission. F8

Climate-resilient projects: We commend Massport for hiring its first Program Manager for Resiliency in 2014. Robbin Peach is an experienced state manager and familiar with climate action. She will no doubt help move Massport forward on climate preparedness.

Prior to Robbin Peach's hire, the 2012/2013 Environmental Data Report noted that a Resiliency Working Group has been established to "identify threats, hazards, likely scenarios, and current vulnerabilities. The findings of the Working Group will inform overall strategic planning decisions and priority setting" (page 3-27). A Disaster and Infrastructure Resiliency Planning Study of the airport is also underway. We ask that the Secretary's Certificate have Massport distribute this latter study, at a minimum, to all commenters of the Environmental Data Report and to any interested parties who request it, and that Massport solicit comments from these parties and others on the study and implementation measures. F9

Thank you for your consideration.

Sincerely,

Vivien Li
President
The Boston Harbor Association

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Comment #	Author	Topic	Comment	Response
F.1	Vivien Li Boston Harbor Association President	Regional Transportation / Ground Access	Given the level of Massport subsidy, we urge greater marketing of the free Silver Line service to South Boston and to South Station in an effort to further reduce automobile usage.	Massport has an existing marketing strategy for the Silver Line including posters, notices on the website, and other general advertising. Massport will continue to look at ways to market the service and increase utilization.
F.2	Vivien Li Boston Harbor Association President	Ground Access	Consistent with the Massachusetts State Implementation Plan, we support efforts to discourage automobile usage, and strongly urge that "Restricted Use Parking Spaces" currently provided free of charge be eliminated.	The Logan Airport Parking Freeze requirement does not allow Massport to charge for these Restricted Use spaces.
F.3	Vivien Li Boston Harbor Association President	Ground Access	Consistent with the goals of the State Implementation Plan under the Federal Clean Air Act, we support continued, significant parking rate increases to discourage automobile usage and to generate funds to further help subsidize transit options.	Massport continually evaluates the parking rate structure at Logan Airport and will continue to do so in the future.
F.4	Vivien Li Boston Harbor Association President	Regional Transportation / Ground Access	Given the new but highly experienced operator now at the airport, we believe it would be timely for Massport to convene a meeting of water transportation operators, municipal officials, and advocates to discuss water transportation routes, fare structures, and marketing.	Massport would be happy to participate in such a group meeting with appropriate state agencies and stakeholders to discuss water transportation options.
F.5	Vivien Li Boston Harbor Association President	Mitigation	For all future projects, we ask that the Environmental Secretary require that the environmental commitment/mitigation be completed by the time of the issuance of a certificate of occupancy so that there is not a multi-year delay between project completion and completion of the environmental commitment/mitigation.	Massport will continue to meet its mitigation obligations as it has in the past. We are proud of our role in facilitating the public process and expediting concept, design and construction of the Greenway Connector Project.

Comment #	Author	Topic	Comment	Response
F.6	Vivien Li Boston Harbor Association President	Mitigation	We ask that the Secretary reinforce that tree removal should be avoided. In the event that tree removal cannot be avoided, the replacement ratio used by the Boston Conservation Commission (2:1 or 3:1 replacement ratio) would be a useful one to implement. Such tree replacement should occur in the immediate area of Logan Airport, including open spaces and Airport Buffer Areas and/or in the abutting neighborhoods and communities of East Boston and Winthrop.	Over the past 20 years, Massport has continued to upgrade and improve Logan Airport's open space on the airport,and in adjacent communities and has dramatically increased the amount of tree planting, shrubs and landscaping at the airport.
F.7	Vivien Li Boston Harbor Association President	Mitigation	We urge that the Secretary's Certificate require that any future mitigation measures required of Logan Airport projects be located in the same watershed area where the adverse impacts will occur.	Massport has worked closely with the Massachusetts Department of Environmental Protection (MassDEP) and other agencies and stakeholders to find appropriate mitigation sites within the existing watershed area as well as outside, if necessary. We continue to comply with the requirements of the MassDEP as well as FAA's wildlife hazard management guidance.
F.8	Vivien Li Boston Harbor Association President	Operations	We continue to urge that Massport identify additional "snow farm" locations so that there is not a need to request permission to lift the ban on snow dumping into Boston Harbor except potentially during blizzards when there may be insufficient locations to handle snow from airport runways.	Massport has instituted policies to reduce the need to request snow dumping, except in extreme situations such as the winter of 2014/2015. In the event of a major storm, Massport has best management practices (BMPs) in place to limit the amount of snow that needs to be moved or placed in the harbor.
F.9	Vivien Li Boston Harbor Association President	General	We ask that the Secretary's Certificate have Massport distribute this latter study [DIRP Study], at a minimum, to all commenters of the Environmental Data Report and to any interested parties who request it, and that Massport solicit comments from these parties and others on the study and implementation measures.	Information on Massport's resiliency program is available on Massport's website at https://www.massport.com/business-with-massport/resiliency/. Information on the Disaster and Infrastructure Resiliency Planning (DIRP) Study is reported on in the *2014 EDR*. Please see Chapter 1, *Introduction/Executive Summary* and Chapter 3, *Airport Planning*.

Nancy S. Timmerman, P.E.
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January 27, 2015

The Honorable Matthew A. Beaton, Secretary
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
Anne Canaday, EOEA No. 3247
100 Cambridge Street, Suite 900
Boston, MA 02114

Subject: EOEA #3247-Boston-Logan Airport 2012/2013 Environmental Data Report (EDR)

Dear Secretary Beaton:

These comments are being transmitted by email.

I have reviewed the 2012/2013 Environmental Data Report (EDR), EOEA #3247 and offer the following comments and questions.

It is a good thing that Massport has instituted the Boston Logan Express service, providing a direct link between downtown and the airport.

It is also a good thing that the MBTA Silver Line provides free transportation to South Station, where the connections to the rest of the MBTA service are also free. Do the customer service representatives point this out to the public, to encourage its use? G1

In the Ground Transportation section, a grouping is made of Urban Core which is Boston, Brookline, Cambridge, and Somerville (according to the text with MBTA service). If this is true, why weren't the following cities included: Revere (Blue line), Quincy (Red line), Braintree (Red line), Milton (Red line), Medford (Orange line), and Everett (Orange line)? One would think at least Revere would be included. G2

It is also a good thing that Massport has constructed the consolidated car rental facility. This single project improves congestion at the curb, reduces car rental vehicle trips and reduces the attendant emissions from their operation.

With respect to the Preferential Runway Advisory System (PRAS), how is Massport working with the FAA to encourage changing runway configuration use, since it is known that a change of runway configuration takes time and effort? G3

Why was noise monitoring Site 12 decommissioned in 2010, and what has been the trouble at Site 3, since it cannot be relied upon? G4

The comparison between modeled and measured noise levels for 2011 and 2012 continues to show a bias of measured DNL lower than modeled for virtually all monitoring locations, and especially for locations whose modeled levels are above 60 dB. It appears that thresholds are used in reporting the measured aircraft-only DNL. If the thresholds are too high, the assumed aircraft-only DNL will be too low. G5

Runway 14/32 was constructed at considerable cost. Since it has been in operation, it has been used for at most 1% of operations. One would have thought the usage would be higher.

In Figure 6-3, the graphic for jet departures, it is clear that there were jet operations in October, 2013, from Runway 22R which flew straight out from the airport. What did the airport do to investigate these operations? G6

Thank you for giving me the opportunity to comment on this report.

Sincerely,

Nancy S. Timmerman, P.E.

cc: T. Ennis, Massport
S. Dalzell, Massport
Letter to MEPA Office/EOEA #3247--2012/2013EDR

Comment #	Author	Topic	Comment	Response
G.1	Nancy S. Timmerman, P.E. Consultant in Acoustics and Noise Control, Boston, MA	Regional Transportation / Ground Access	Do the customer service representatives point out [the Silver Line] to the public, to encourage its use?	Massport has an extensive public information program for the ground transportation services to and from Logan Airport. Signage is provided throughout the terminal complex and at the curbs, as well as on Massport's website. https://www.massport.com/logan-airport/to-and-from-logan/
G.2	Nancy S. Timmerman, P.E. Consultant in Acoustics and Noise Control, Boston, MA	Regional Transportation	In the Ground Transportation section, a grouping is made of Urban Core which is Boston, Brookline, Cambridge, and Somerville (according to the text with MBTA service). If this is true, why weren't the following cities included: Revere (Blue line), Quincy (Red line), Braintree (Red line), Milton (Red line), Medford (Orange line), and Everett (Orange line)?	The grouping was made for the purposes of describing ground-access travel behavior by Logan Airport air passengers. The Urban Core grouping represents those communities served by the MBTA rapid transit system that generate a high number of air passenger trips relative to other communities, and thus their shared characteristics presented a natural cut-off boundary.
G.3	Nancy S. Timmerman, P.E. Consultant in Acoustics and Noise Control, Boston, MA	Operations	With respect to the Preferential Runway Advisory System (PRAS), how is Massport working with the FAA to encourage changing runway configuration use, since it is known that a change of runway configuration takes time and effort?	As reported in the *2012/2013 EDR* , Massport is participating in an FAA aircraft noise study as part of the Airside Improvement Project mitigation. The primary focus of the Boston Logan Airport Noise Study (BLANS) is to determine viable ways to reduce noise from aircraft operations to and from Logan Airport without diminishing airport safety and efficiency. The RNAV departure portions of Phase 1 of the project, first implemented in 2010, continued to be utilized in 2012 and 2013. During Phase 2 of the on-going BLANS the Logan Airport Community Advisory Committee (CAC) voted to abandon PRAS because it had not achieved the intended noise abatement. Phase 3 of the BLANS is focusing on the development of an updated Runway Use Program. The findings of this study will be reported in future EDRs and ESPRs.

Comment #	Author	Topic	Comment	Response
G.4	Nancy S. Timmerman, P.E. Consultant in Acoustics and Noise Control, Boston, MA	Noise	Why was noise monitoring Site 12 decommissioned in 2010, and what has been the trouble at Site 3, since it cannot be relied upon?	Noise monitoring Site 12 was not decommissioned. Massport was asked to relocate the site by the property landlord and Massport will continue to work towards finding an alternative site for this noise monitor in East Boston. Massport is actively working on local technical issues concerning Site 3.
G.5	Nancy S. Timmerman, P.E. Consultant in Acoustics and Noise Control, Boston, MA	Noise	The comparison between modeled and measured noise levels for 2011 and 2012 continues to show a bias of measured DNL lower than modeled for virtually all monitoring locations, and especially for locations whose modeled levels are above 60 dB. It appears that thresholds are used in reporting the measured aircraft-only DNL. If the thresholds are too high, the assumed aircraft-only DNL will be too low.	The Noise monitors do use a threshold to help identify aircraft events from community events. Massport continually reviews these settings and makes adjustments where necessary.
G.6	Nancy S. Timmerman, P.E. Consultant in Acoustics and Noise Control, Boston, MA	Operations	In Figure 6-3, the graphic for jet departures, it is clear that there were jet operations in October, 2013, from Runway 22R which flew straight out from the airport. What did the airport do to investigate these operations?	Massport coordinates with the FAA regarding operational needs. From time to time, the FAA cannot follow noise abatement procedures due to factors such as weather or safety concerns.

C

Proposed Scope for the *2015 EDR*

PROJECT NAME:	*Logan Airport 2014 Environmental Data Report*
PROJECT LOCATION:	East Boston, Massachusetts
EOEA NUMBER:	3247
PROJECT PROPONENT:	Massachusetts Port Authority (Massport)

Massport respectfully submits this proposed scope for the *Logan Airport 2015 Environmental Data Report (EDR)* for public review and comment. The *2015 EDR* would follow the *2014 EDR*, which was filed in September 2015. Massport will continue to use this process to evaluate the cumulative impacts associated with Logan Airport activities through preparation of an Environmental Status and Planning Report (ESPR) approximately every five years with data updates annually through the EDRs. The next ESPR will provide the most recent passenger and operations forecasts for Logan Airport and compare to historic trends. Massport will continue to provide updates on key environmental topics on the Massport website (http://www.massport.com/environment).

Purpose of the *Logan Airport 2015 EDR*

For over three decades, the Logan Airport EDRs and ESPRs have provided information to the public on planning activities, aircraft operations and passenger activity levels, and Massport initiatives at Logan Airport. The *2015 EDR* will provide an update on conditions at Logan Airport for calendar year 2015. The EDR will continue to serve as a background/context against which projects at Logan Airport can be evaluated. It also will report on the cumulative effects of Logan Airport operations and activities, compared to previous years, as appropriate.

The EDR/ESPRs serve as the baseline analyses for project-specific environmental reviews and provide a forum for updates on Massport's mitigation program. By providing the Airport-wide contexts for air quality, noise, ground transportation, and water quality, the EDR/ESPRs help focus the review processes for state Environmental Notification Forms (ENFs) and, if necessary, Environmental Impacts Reports (EIRs). In this manner, Massport ensures that segmented project review does not occur in the context of Massachusetts Environmental Policy Act (MEPA) review of projects at Logan Airport. The EDRs/ESPRs also provide context for any Federal National Environmental Policy Act (NEPA) reviews by the Federal Aviation Administration serving as the lead federal agency.

Contents of the *2015 EDR*

Generally, the *2015 EDR* will follow the format of the *2014 EDR*, presenting an overview of the role of Logan Airport in the regional planning context. The *2015 EDR* will report on 2015 passenger and aircraft operation activity levels. This will be followed by a status report on Massport's proposed planning initiatives, projects, and mitigation. In this way, Massport will provide necessary background information to allow the reviewer to understand the environmental policies and planning which form the context of the environmental reporting, technical studies, and environmental mitigation initiatives at Logan Airport.

The technical studies in the *2015 EDR* will include reporting on and analysis of key indicators of airport activity levels, the regional transportation system, ground access, noise, air quality, water quality and environmental management, and project mitigation tracking. Sustainability initiatives are included throughout the document. Each chapter's contents are described below.

1. Introduction/Executive Summary

This chapter of the *2015 EDR* will include:

- Highlights of 2015 planning and environmental conditions
- Overview of Logan Airport and place it in its environmental, geographic, and regulatory context
- Overview of the EDR/ESPR cycle
- Highlights of passenger activity levels and aircraft operations
- Description of the analysis framework for the environmental reporting and technical studies to be conducted
- Overview of the Logan Airport planning initiatives and projects
- Overview of sustainability initiatives at Logan Airport
- Organization of the *2015 EDR*

2. Activity Levels

A primary purpose of this chapter will be to report on airport activity levels for 2015, including:

- Aircraft operations, including fleet mix and scheduled airline services at Logan Airport
- Domestic and International passenger activity levels
- Cargo and mail volumes
- Compare 2015 aircraft operations, cargo/mail operations, and passenger activity levels to 2014 activity levels
- Report on national aviation trends in 2015 and compare to trends at Logan Airport

3. Airport Planning

Massport continues to assess planning strategies for improving Logan Airport's operations and services in a safe, secure, more efficient, and environmentally sensitive manner. As owner and operator of Logan Airport, Massport also must accommodate and guide tenant development. This chapter will describe the status of planning initiatives for the following areas:

- Terminal Area
- Airside Area
- Service and Cargo Areas

- Roadways and Airport Parking
- Airport Buffers and Landscaping

Massport is planning for the ongoing improvement of Logan Airport facilities as well as enhancing access to and from the Airport. The chapter will report on the status of projects implemented within the boundaries of Logan Airport either by Massport, its tenants, or other state entities. The chapter will also report on the status and effectiveness of the ground access related changes including roadway and parking projects, which consolidate and direct airport-related traffic to centralized locations and minimize airport-related traffic on external streets in adjacent neighborhoods.

4. Regional Transportation

The *2015 EDR* will describe Logan Airport's role in the region's intermodal transportation system by reporting on the following:

<u>Regional Airports</u>
- 2015 regional airport operations, passenger activity levels, and schedule data within an historical context
- Status of plans and new improvements as provided by the regional airport authorities
- Ground access improvements to the regional airports
- The role that Worcester Regional Airport and Hanscom Field play in the regional aviation system and Massport's efforts to promote these airports

<u>Regional Transportation System</u>
- Massport's role in managing regional aviation facilities.
- Massport's cooperation with other transportation agencies to promote efficient regional highway and transit operations
- Report on metropolitan and regional rail initiatives and ridership

5. Ground Access to and from Logan Airport

The chapter will report on 2015 conditions and provide a comparison to those of 2014 for the following:

- Logan Airport Parking Freeze
- High occupancy vehicle (HOV) ridership (including Blue Line, Silver Line, Scheduled, Unscheduled, Water Transportation, and Logan Express)
- Logan Airport Employee Transportation Management Association (Logan TMA) services
- Logan Airport gateway volumes
- On-airport traffic volumes/vehicle miles traveled (VMT)
- Parking demand and management (including rates and duration statistics)
- Status of long-range ground access management strategy planning

This chapter will also present a discussion of the following topics:
- Massport's cooperation with other transportation agencies to increase transit ridership to and from Logan Airport via the Blue Line and Silver Line
- Report on Logan Express usage and efforts to increase capacity and usage
- Report on water transportation to and from Logan Airport
- Report on results of ongoing ground access studies, as relevant

6. Noise Abatement

This chapter will provide an overview of the environmental regulatory framework affecting aircraft noise, the changes in aircraft noise, and the updates in noise modeling. The chapter will report on 2015 conditions and compare those conditions to those of 2014 for the following:

- Fleet Mix, including Stage II, Recertified (Hushkitted) Stage III, newly manufactured Stage III, and qualifying Stage IV aircraft
- Nighttime operations
- Runway utilization (report on aircraft and airline adherence with runway utilization goals)
- Flight tracks

In 2015, the Federal Aviation Administration (FAA) introduced a new combined noise and air quality modeling tool, the Aviation Environmental Design Tool (AEDT) that is to be used for all airport projects. This new tool is a software system that dynamically models aircraft performance in space and time to produce fuel burn, emissions, and noise information. Noise contours for 2015 will be developed using AEDT and compared to the most recent version of the Integrated Noise Model (INM) which has been in place for all previous EDRs and ESPRs. Logan Airport-specific model adjustments made to account for over-water sound propagation and the propagation of sound to areas of higher terrain may be reported as an add-on to AEDT, if accepted by the FAA. This chapter will report on the following:

- Changes in annual noise contours and noise-impacted population
- Measured versus modeled noise values, including reasons for differences and any improvements attributable to the models deployed
- Cumulative Noise Index (CNI)
- Times-Above for 65, 75, and 85 dBA threshold values/Dwell and Persistence of noise levels
- Flight track monitoring noise reports

The chapter will also report on noise abatement efforts, results from Boston Logan Airport Noise Study (BLANS) study, and provide a status update on the noise and operations monitoring system.

7. Air Quality/Emissions Reductions

This chapter will begin with an overview of the environmental regulatory framework affecting aircraft emissions, changes in aircraft emissions, and the changes in air quality modeling. The chapter will provide discussion on progress on the national and international levels to decrease air emissions. The chapter will also discuss analysis methodologies and assumptions and report on 2015 conditions using the FAA's new AEDT model, described above. It will compare results to the most recent version of the Emissions Dispersion Modeling System (EDMS) that has been used in recent EDR/ESPR filings. The EPA required motor vehicle emissions modeling tool (MOtor Vehicle Emission Simulator (MOVES[1]) will continue to be used to assess vehicular emission on airport roadways. The chapter will include:

- Emissions inventory for carbon monoxide (CO)
- Emissions inventory for oxides of nitrogen (NO_x)
- Emissions inventory for volatile organic compounds (VOCs)
- Emissions inventory for particulate matter (PM)
- NO_x emissions by airline

1 MOVES replaces the previous model for deriving on-road mobile source emissions, MOBILE6.2; MassDEP directed that MOVES should be used for the EDR analysis for consistency with the SIP and DEP's methodologies.

This chapter will also report on the following ongoing air quality efforts for 2015:

- Air Quality Initiative (AQI) Tracking
- Massport's and tenant's alternative fuel vehicle programs
- The status of Logan Airport air quality studies undertaken by Massport or others, as available

This chapter will include Massport's voluntary inventory of greenhouse gas (GHG) emissions from Logan Airport in 2015. GHG emissions will be quantified for aircraft, ground service equipment (GSE), motor vehicles and stationary sources using emission factors and methodologies outlined in the Greenhouse Gas Emissions Policy and Protocol issued by the Executive Office of Energy and Environmental Affairs (EEA) and the Transportation Research Board's *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (Airport Cooperative Research Program (ACRP) Report 11, Project 02-06). The results of the 2015 GHG emissions inventory will be compared to the 2014 results.

This chapter will also include an update on Massport's efforts to encourage the use of single engine taxiing under safe conditions.

8. Water Quality/Environmental Compliance and Management

This chapter will report on the 2015 status of:

- National Pollutant Discharge Elimination System (NPDES) Permit and monitoring results for Logan Airport's outfalls and the Fire Training Facility
- Jet fuel usage and spills
- Massachusetts Contingency Plan (MCP) Activities
- Tank management
- Update on the environmental management plan
- Fuel spill prevention

The chapter will also present a discussion of the following topics:

- Future stormwater management improvements (if any)
- Future MCP and tank management activities

9. Project Mitigation Tracking

This chapter will report on the status of mitigation commitments for specific Massport and tenant projects at Logan Airport that have undergone MEPA review and other commitments and have commenced construction. The status of mitigation commitments made in the Section 61 Findings for the following projects will be reported:

- West Garage/Central Garage (EOEA 9790)
- International Gateway (EOEA 9791)
- Logan Airside Improvements Planning Project (EOEA 10458)
- Terminal A Replacement Project (EOEA 12096)
- Southwest Service Area Redevelopment Program/Rental Car Center (EOEA 14137)
- Logan Runway Safety Area Improvements Project (EOEA 14442)

This chapter will update the status of Massport's mitigation commitments and also will identify projects for which mitigation is complete.

Appendices

MEPA Documentation

These appendices will include a copy of the Secretary's Certificate and comment letters received on the *2015 EDR*. Individual responses to items raised in the Secretary's Certificate on the *2014 EDR* and comments in reviewers' letters will be provided. A distribution list for the *2015 EDR* (indicating those receiving documents or CDs) will be provided. The document will also contain copies of any MEPA Certificates or documentation issued for projects at Logan Airport in 2015.

Supporting Technical Documentation

Supporting technical appendices will be provided as necessary.

D

Distribution

This *2014 Environmental Data Report (EDR)* has been distributed to federal, state, and city agencies and to parties listed in this appendix. The list includes those entities that the Massachusetts Environmental Policy Act (MEPA) requires as part of the review of the document, representatives of governmental agencies, commenters on the *2012/2013 EDR*, and community groups concerned with airport activities.

The *2014 EDR* is also available on Massport's website at www.massport.com and electronically on compact disc (CD). Limited CD or printed copies of the *2014 EDR* may be requested from Stewart Dalzell, Massport, Suite 200S, Logan Office Center, One Harborside Drive, East Boston, MA 02128, telephone (617) 568-3507, e-mail: sdalzell@massport.com. Printed and electronic copies of this report are available for review at the following public libraries:

Table D-1 Libraries

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Some parties listed in Table D-2 have been provided a hard copy of the document along with a CD of the complete document. A second group of parties have been provided with a CD only.

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Technical Appendices

- Appendix E – Activity Levels
- Appendix F – Regional Transportation
- Appendix G – Ground Access
- Appendix H – Noise Abatement
- Appendix I – Air Quality/Emissions Reduction
- Appendix J – Water Quality/Environmental Compliance and Management
- Appendix K – 2014 Peak Period Pricing Monitoring Report
- Appendix L – Reduced/Single Engine Taxiing at Logan Airport Memorandum

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E

Activity Levels

This appendix provides detailed tables in support of *Chapter 2, Activity Levels*:

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Table E-1 Logan Airport Historic Air Passenger and Operations Data

Year	Operations	Air Passengers	Year	Operations	Air Passengers
1980	258,167	14,722,363	1998	507,449	26,526,708
1981	251,961	14,827,684	1999	494,816	27,052,078
1982	244,468	15,867,722	2000	487,996	27,726,833
1983	288,956	17,848,797	2001	463,125	24,474,930
1984	318,959	19,417,971	2002	392,079	22,696,141
1985	349,518	20,448,424	2003	373,304	22,791,169
1986	363,995	21,862,718	2004	405,258	26,142,516
1987	414,968	23,369,002	2005	409,066	27,087,905
1988	407,479	23,732,959	2006	406,119	27,725,443
1989	388,797	22,272,860	2007	399,537	28,102,455
1990	424,568	22,878,191	2008	371,604	26,102,651
1991	430,403	21,450,143	2009	345,306	25,512,086
1992	474,378	22,723,138	2010	352,643	27,428,962
1993	493,093	23,579,726	2011	368,987	28,909,267
1994	458,623	24,468,178	2012	354,869	29,236,087
1995	466,327	24,192,095	2013	361,339	30,218,970
1996	456,226	25,134,826	2014	363,797	31,634,445
1997	482,542	25,567,888			

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Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier

Airline	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
Scheduled Jet Carriers	233,993	190,991	203,081	207,369	203,376	211,176	214,854	3,678	1.7%
AirTran Airlines	3,090	14,580	13,672	12,869	10,883	7,764	3,442	-4,322	-55.7%
Alaska Airlines		1,088	1,733	1,757	1,873	2,661	3,090	429	16.1%
America West Airlines	5,116	4,467							
American Airlines	30,821	27,712	21,313	18,943	20,962	22,535	22,486	-49	-0.2%
American Trans Air	1,448	2,294							
Continental Airlines	16,894	13,546	10,869	11,074	1,546				
Delta Subtotal	52,954	36,388	28,980	25,429	23,270	21,139	23,614	2,475	11.7%
Delta Air Lines Mainline	*22,031*	*14,317*	*21,926*	*19,633*	*23,270*	*21,139*	*23,614*	*2,475*	*11.7%*
Delta Express	*13,746*								
Delta Shuttle	*17,177*	*9,588*	*7,054*	*5,796*					
Delta Song		*12,483*							
Frontier Airlines	1,052		1,094		275				
Independence Air		4,676							
JetBlue Airways		15,069	49,981	58,737	63,210	73,374	76,247	2,873	3.9%
Midway Airlines	4,096								
Midwest Airlines	3,726	3,570	1,961	2,786					
Northwest Airlines	13,147	9,685							
People Express							170		
Southwest Airlines			13,727	17,413	12,784	15,937	18,525	2,588	16.2%
Spirit Airlines			3,023	3,054	3,365	2,721	2,945	224	8.2%
Sun Country Airlines	723		313	509	596	926	1,027	101	10.9%
Trans World Airlines	6,280								
United Airlines	28,092	18,304	16,314	15,351	24,090	25,214	24,374	-840	-3.3%
US Airways	66,554	39,612	36,678	36,421	36,633	35,613	35,736	123	0.3%
Virgin America			3,394	3,026	3,889	3,292	3,198	-94	-2.9%

Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier (Continued)

Airline	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
Regional/Commuter Carriers	160,041	137,203	94,535	89,586	81,802	81,935	78,696	-3,239	-4.0%
America West Express	1,267								
American Airlines Subtotal									
Chautauqua Airlines (American Airlines)									
American Eagle Airlines	62,140	37,394	15,291	6,669	4	4	5	1	25.0%
Cape Air	31,026	25,018	35,899	35,940	37,184	37,194	35,080	-2,114	-5.7%
Continental Connection Subtotal			1,809	1,199	131				
Colgan Air (Continental Connection)			*1,809*	*1,199*	*131*				
Continental Express Subtotal		12,544	529	902	385				
Atlantic SE (Continental Express)				*134*					
Chautauqua Airlines (Continental Express)			*529*	*719*	*185*				
Commutair (Continental Express)		*12,544*							
Express Jet (Continental Express)					*86*				
Trans States Airlines (Continental Express)				*49*	*114*				
Delta Connection Subtotal	15,438	26,557	18,445	23,243	20,925	20,848	20,265	-583	-2.8%
ACJet (Delta Connection)	*2,258*								
Atlantic SE (Delta Connection)			*943*	*4,948*					
Big Sky Airlines (Delta Connection)									
Chautauqua Airlines (Delta Connection)		*1,938*	*1,794*	*2,230*	*1,926*	*1,860*	*1,683*	*-177*	*-9.5%*
Comair Airlines (Delta Connection)	*520*	*24,619*	*10,255*	*7,857*	*5,824*				
Compass Airlines (Delta Connection)			*1,053*	*1,577*	*574*	*14*	*28*	*14*	*100.0%*
Express Jet (Delta Connection)					*1,648*	*3,771*	*1,489*	*-2,282*	*-60.5%*
Freedom Airlines (Delta Connection)									
Go Jet (Delta Connection)					*88*	*6*	*476*	*470*	*7833.3%*
Mesaba Airlines (Delta Connection)			*1,078*	*3,117*	*21*				
Pinnacle Airlines (Delta Connection)			*1,278*	*1,507*	*3,689*	*4,747*	*7,310*	*2,563*	*54.0%*
Shuttle America (Delta Connection)			*2,044*	*2,007*	*7,155*	*10,450*	*9,279*	*-1,171*	*-11.2%*
Trans States Airlines (Delta Connection)	*12,660*								
MidAtlantic Express									
Midwest/Republic			258						
Northwest Airlink Subtotal		5,034							
Compass Airlines (Northwest Airlink)									
Pinnacle Airlines (Northwest Airlink)		*5,034*							

Table E-2 Logan Airport Changes in Domestic Passenger Operations by Carrier (Continued)

Airline	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
PenAir					2,268	4,384	4,382	-2	0.0%
Republic Airlines						58	53	-5	-8.6%
United Express Subtotal		3,178	2,802	2,763	4,342	5,829	5,628	-201	-3.4%
ACJet (United Express)									
Air Wisconsin (United Express)		*1,699*							
Atlantic SE (United Express)			*574*	*6*					
Chautauqua Airlines (United Express)		*103*			*976*	*1,527*	*187*	*-1,340*	*-87.8%*
Colgan Air (United Express)					*334*				
Express Jet (United Express)					*1,089*	*973*	*2,092*	*1,119*	*115.0%*
Mesa Airlines (United Express)		*1,376*	*434*	*258*	*18*	*886*	*1,404*	*518*	*58.5%*
Republic Airlines (United Express)						*196*	*217*	21	10.7%
Shuttle America (United Express)			*1,561*	*1,941*	*1,023*	*1,597*	*416*	*-1,181*	*-74.0%*
SkyWest Airlines (United Express)						*469*	*1,152*	*683*	*145.6%*
Trans States Airlines (United Express)			*233*	*558*	*902*	*181*	*160*	*-21*	*-11.6%*
US Airways Express Subtotal	50,170	27,478	19,502	18,870	14,551	11,605	11,269	-336	-2.9%
Air Wisconsin (US Airways Express)		*174*	*6,266*	*6,499*	*6,664*	*6,440*	*6,165*	*-275*	*-4.3%*
Allegheny (US Airways Express)	*9,537*								
Chautauqua Airlines (US Airways Express)	*0*	*7,852*	*3*						
Colgan Air (US Airways Express)	*11,390*	*12,583*	*9,256*	*8,302*	*2,114*				
Commutair (US Airways Express)	*25,774*								
Mesa Airlines (US Airways Express)	*3,469*	*4*							
MidAtlantic Express (US Airways Express)		*150*							
Piedmont Airlines (US Airways Express)		*3,165*	*963*	*1,325*	*2,428*	*1,951*	*1,858*	*-93*	*-4.8%*
PSA (US Airways Express)		*526*	*2*	*5*					
Republic (US Airways Express)		*46*	*3,012*	*2,739*	*3,345*	*3,214*	*3,246*	*32*	*1.0%*
Trans States Airlines (US Airways Express)		*2,978*							
Non-Scheduled Operations (Incl. Charter)	1,008	325	501	106	-1,831	-1,813	-1,850	-37	2.0%
Total Domestic Operations	395,042	328,519	298,117	297,061	283,347	291,298	291,700	402	0.1%

Note: Excludes general aviation and all-cargo operations.
Source: Massport

Table E-3 Logan Airport Changes in International Passenger Operations by Carrier

Airline	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
Scheduled Jet Carriers	27,427	24,550	20,771	26,984	27,645	25,314	27,079	1,765	7.0%
Aer Lingus	1,160	1,016	1,097	1,130	1,273	1,513	1,933	420	27.8%
Aeromexico		534							
Air Canada	10,047	5,782	3,895	4,125	4,517	1,747	1,084	-663	-38.0%
Air France	1,046	1,334	995	1,013	974	955	899	-56	-5.9%
Air Jamaica		349							
Air One									
Alitalia	729	986	624	604	530	542	550	8	1.5%
American Airlines	4,657	4,672	2,422	2,149	1,901	447	139	-308	-68.9%
Astraeus				100					
British Airways	2,159	2,151	2,082	2,161	2,149	2,573	2,678	105	4.1%
Canadian Airlines	417								
Copa Airlines						347	730	383	110.4%
Delta Air Lines	733	749	1,614	3,280	2,531	2,851	3,008	157	5.5%
Emirates							600	600	100.0%
Finnair		44							
FlyGlobespan									
Frontier Airlines									
Hainan Airlines							280	280	100.0%
Iberia Airlines			435	445	441	404	332	-72	-17.8%
Icelandair	726	811	816	928	938	1,120	1,227	107	9.6%
Japan Airlines					474	646	731	85	13.2%
JetBlue			2,262	5,173	5,902	6,138	6,348	210	3.4%
Korean Air Lines	314								
LACSA Airlines									
Lufthansa	1,140	1,564	1,657	1,734	1,784	1,723	1,712	-11	-0.6%
Northwest Airlines	744	727	61						

Table E-3 Logan Airport Changes in International Passenger Operations by Carrier (Continued)

Airline	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
Olympic Airways	256								
Sabena	724								
SATA International Airlines		315	403	400	412	466	533	67	14.4%
SWISS International	926	704	720	725	716	720	722	2	0.3%
TACA		327							
TACV - Cabo Verde		154	240	236	234	214	186	-28	-13.1%
TAP - Air Portugal	200								
Trans World Airlines									
Turkish Airlines							452	452	100.0%
United Airlines	728								
US Airways		1,607	667	49	146	186	205	19	10.2%
VG Airlines									
Virgin Atlantic Airways	721	724	707	721	711	709	716	7	1.0%
Regional/Commuter Carriers	15,594	13,112	12,494	12,153	12,270	14,378	14,720	342	2.4%
Air Canada Regional	4,088	5,120	7,065	6,803	7,058	9,563	10,364	801	8.4%
Jazz Air (Air Canada Regional)						*6,422*	*6,381*	-41	-0.6%
Sky Regional Airlines (Air Canada Regional)						*3,141*	*3,983*	842	26.8%
American Eagle Airlines	8,975	4,637	2,480	2,206					
Delta Connection Subtotal	2,531	3,355	81	1	1,489	1,082	56	-1,026	-94.8%
ACJet (Delta Connection)									
Big Sky Airlines (Delta Connection)									
Comair Airlines (Delta Connection)	*2,531*	*3,355*	*81*	*1*					
Endeavor Air (Delta Connection)					*1,489*	*1,082*	*0*	*-1,082*	*-100.0%*
Shuttle America (Delta Connection)							*56*	56	100.0%
Porter Airlines			2,868	3,143	3,723	3,733	4,300	567	15.2%
Non-Scheduled Operations	2,141	1,068	305	300	268	277	185	-92	-33.2%
Total International Operations	45,162	38,643	33,570	39,437	40,183	39,969	41,984	2,015	5.0%

Note: Excludes general aviation and all-cargo operations.

Source: Massport

Table E-4 Logan Airport Scheduled Passenger Departures by Destination

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
Domestic		210,068	163,684	149,962	152,303	145,883	149,091	151,222	2,130	1.4%
New York La Guardia	LGA	11,872	13,350	11,705	11,489	9,564	9,255	9,056	-199	-2.1%
Washington National	DCA	8,474	10,680	9,419	9,793	8,543	8,360	8,645	285	3.4%
Philadelphia	PHL	11,785	7,014	6,548	7,985	6,301	7,305	8,092	787	10.8%
Chicago O'Hare	ORD	10,063	7,412	7,403	7,635	7,461	7,733	7,822	89	1.2%
New York J F Kennedy	JFK	9,899	4,985	7,054	5,969	5,428	5,919	6,139	219	3.7%
New York Newark	EWR	5,206	5,626	3,666	4,608	5,228	5,702	5,532	-171	-3.0%
Atlanta	ATL	7,110	6,003	5,548	5,569	5,574	5,501	5,454	-48	-0.9%
Baltimore	BWI	1,773	5,029	7,053	6,755	5,910	5,737	5,060	-678	-11.8%
San Francisco	SFO	3,526	2,591	3,711	3,884	4,198	4,038	4,305	268	6.6%
Los Angeles	LAX	3,647	2,655	3,382	3,164	3,544	3,603	4,080	477	13.2%
Charlotte	CLT	2,758	3,288	4,180	3,976	3,991	3,911	3,916	5	0.1%
Dallas/Fort Worth	DFW	5,002	3,544	2,938	2,781	3,790	4,147	3,705	-442	-10.7%
Raleigh/Durham	RDU	3,775	4,110	3,259	2,867	3,059	3,313	3,634	321	9.7%
Nantucket	ACK	5,022	3,452	3,884	3,382	3,469	3,601	3,567	-34	-0.9%
Detroit	DTW	2,937	2,827	2,353	2,437	2,314	2,340	3,354	1,015	43.4%
Orlando	MCO	4,914	3,517	3,179	3,580	3,496	3,399	2,883	-516	-15.2%
Martha's Vineyard	MVY	3,863	2,231	3,218	2,829	2,774	2,740	2,793	53	1.9%
Washington Dulles	IAD	8,625	6,139	4,625	3,910	3,014	2,974	2,714	-260	-8.8%
Pittsburgh	PIT	3,086	2,021	2,312	3,179	2,498	2,641	2,678	37	1.4%
Miami	MIA	2,068	2,072	2,238	2,555	2,610	2,555	2,551	-4	-0.2%
Richmond	RIC	1,537	1,404	1,431	1,525	1,481	1,723	2,450	727	42.2%
Denver	DEN	2,628	1,990	2,812	2,640	2,518	2,433	2,446	13	0.6%
Buffalo	BUF	950	1,226	2,181	2,183	2,264	2,468	2,433	-35	-1.4%
Minneapolis	MSP	3,078	1,791	1,927	2,031	2,062	2,200	2,322	122	5.6%
Fort Lauderdale/Hollywood	FLL	3,327	3,065	2,370	2,517	2,371	2,379	2,173	-206	-8.7%
Provincetown	PVC	2,023	1,659	2,410	2,086	2,054	1,982	1,929	-52	-2.6%
Houston Intercontinental	IAH	1,995	1,752	1,717	1,697	1,704	1,789	1,822	33	1.8%
Fort Myers	RSW	949	1,525	1,587	1,620	1,738	1,806	1,734	-72	-4.0%
Seattle/Tacoma	SEA	458	610	1,001	993	1,051	1,378	1,607	229	16.6%
Phoenix	PHX	1,386	944	1,348	1,895	1,773	1,413	1,557	144	10.2%
Chicago Midway	MDW	868	1,339	1,756	1,751	1,690	1,617	1,542	-76	-4.7%
Lebanon	LEB			1,734	1,460	1,464	1,460	1,460	0	0.0%
West Palm Beach	PBI	1,674	1,126	1,450	1,380	1,161	1,235	1,389	153	12.4%
Houston Hobby	HOU						664	1,325	660	100.0%
Rockland	RKD	1,152	1,374	1,301	1,279	1,282	1,279	1,279	0	0.0%
Cleveland	CLE	2,797	1,260	1,369	1,326	1,455	1,501	1,260	-241	-16.1%
Augusta	AUG	584	621	1,000	1,187	1,091	1,248	1,248	0	0.0%
Cincinnati	CVG	2,235	2,637	1,364	1,308	1,272	1,269	1,239	-30	-2.4%
Tampa	TPA	2,502	1,946	1,246	1,255	1,266	1,195	1,182	-13	-1.1%
Bar Harbor	BHB	1,196	1,154	815	1,030	1,213	1,283	1,156	-127	-9.9%
Albany	ALB	3,433	1,073	647	2,180	1,523	1,183	1,095	-88	-7.4%
Saranac Lake	SLK		800	1,174	1,157	1,222	1,157	1,095	-62	-5.4%
Rutland	RUT	1,259	643	1,095	1,148	1,160	1,095	1,095	0	0.0%
San Diego	SAN	366	365	571	535	476	859	1,030	172	20.0%
Presque Isle	PQI	1,835	1,017	991	991	993	991	991	0	0.0%
Jacksonville	JAX		428	365	544	619	593	984	391	66.1%
Rochester	ROC	3,644	1,181	908	886	889	878	882	4	0.5%
Indianapolis	IND	765	2,076	1,121	977	936	895	844	-51	-5.7%
Columbus	CMH	2,708	2,114	972	1,048	972	871	844	-27	-3.1%
Las Vegas	LAS	1,098	1,679	756	904	737	813	819	6	0.7%
Plattsburgh International	PBG			1,025	899	623	639	787	149	23.3%

Table E-4 Logan Airport Scheduled Passenger Departures by Destination (Continued)

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
Hyannis	HYA	2,274	1,059	1,165	1,047	1,028	705	731	26	3.8%
St. Louis	STL	2,187	1,461	934	713	815	748	722	-26	-3.5%
Milwaukee	MKE	1,189	2,182	2,213	1,941	1,069	880	674	-206	-23.5%
Kansas City	MCI	597	241	313	536	571	515	669	154	29.9%
Nashville	BNA	642				153	588	628	39	6.7%
Syracuse	SYR	3,876	1,762	991	964	784	626	617	-9	-1.4%
Salt Lake City	SLC	1,094	730	669	438	370	584	597	13	2.2%
Portland	PDX			352	440	528	615	494	-121	-19.7%
Charleston	CHS		61				398	474	76	100.0%
Akron/Canton	CAK		730	475	488	497	557	457	-100	-18.0%
Harrisburg	MDT	1,307	886	551	574	540	469	434	-35	-7.5%
Myrtle Beach	MYR	105	265	365	365	366	378	383	4	1.2%
Austin	AUS			365	365	366	352	352	0	0.0%
New Orleans	MSY		191	348	304	335	339	344	5	1.4%
Islip	ISP	4,222	1,581				293	324	31	100.0%
Savannah	SAV		78					306	306	100.0%
Long Beach	LGB		853	459	296	292	274	270	-4	-1.5%
San Jose	SJC	842	245	232	292	227	205	214	9	4.3%
Sarasota/Bradenton	SRQ		30	82	242	248	348	181	-167	-47.9%
Atlantic City Pomona Field	ACY			536	326	355	123	153	30	24.4%
Oakland	OAK		853	195	105	83	83	83	0	0.0%
Norfolk	ORF	838	1,032		511	667	613	71	-541	-88.3%
Newport News	PHF		671	549	549	60		31	31	n/a
Memphis	MEM	972	1,034	1,048	1,029	688	313		-313	-100.0%
Bangor	BGR	6,644	2,946							
Westchester County	HPN	6,065	2,256							
Greensboro	GSO	415	1,120							
Trenton	TTN									
Watertown	ART									
Burlington	BTV	5,913	1,632							
Allentown/Bethlehem	ABE	780	626							
Louisville	SDF									
Manchester	MHT									
Massena	MSS									
Dayton	DAY									
Plattsburgh	PLB									
Portland (ME)	PWM	6,267	1,394							
Wilkes-Barre Scranton	AVP	584	420							
Columbia	CAE									
Ithaca	ITH	872								
Elmira/Corning	ELM	441								
Hartford	BDL									
Binghamton	BGM									
Providence	PVD	91								

Table E-4 Logan Airport Scheduled Passenger Departures by Destination (Continued)

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
International		23,711	19,837	18,764	19,641	21,552	21,106	22,386	1,280	6.1%
Toronto	YYZ	3,691	3,876	3,603	3,737	3,529	3,306	2,715	-591	-17.9%
Toronto Island Apt	YTZ			1,535	1,687	2,009	2,009	2,310	301	15.0%
London Heathrow	LHR	2,187	2,133	2,331	2,833	2,642	2,134	2,069	-65	-3.0%
Montreal-Trudeau	YUL	3,401	2,578	2,008	2,021	2,009	1,833	1,948	115	6.3%
San Juan	SJU	1,750	1,237	1,294	1,130	1,031	1,038	1,018	-20	-1.9%
Paris De Gaulle	CDG	898	853	710	946	619	784	780	-4	-0.5%
Halifax	YHZ	3,210	1,891	852	744	745	704	704	0	0.0%
Dublin	DUB	223		348	457	480	605	653	48	7.9%
Ottawa	YOW	2,575	864	744	696	623	652	635	-17	-2.6%
Reykjavik Keflavik Apt	KEF	393	361	404	531	467	561	614	53	9.4%
Amsterdam	AMS	366	365	457	553	558	575	536	-39	-6.8%
Frankfurt	FRA	580	575	548	544	572	545	532	-13	-2.4%
Bermuda	BDA	550	518	532	540	511	501	523	22	4.3%
Aruba	AUA	9	338	407	426	405	408	417	9	2.2%
Santo Domingo	SDQ		174	305	275	358	339	401	62	18.3%
Zurich	ZRH	523	356	365	365	366	365	365	0	0.0%
Tokyo Narita	NRT					236	352	365	13	3.8%
Panama City	PTY							365	365	n/a
Munich	MUC		210	313	335	357	348	357	8	2.4%
Shannon	SNN	366	737	213	118	144	166	348	182	109.5%
Dubai	DXB							306	306	n/a
Cancun	CUN		207	307	270	217	225	273	49	21.6%
Rome Leonardo Da Vinci-Fiumicino	FCO		135	313	314	266	271	258	-13	-4.8%
Santiago	STI				92	201	214	248	34	15.8%
Istanbul	IST							236	236	n/a
Ponta Delgada	PDL	30	39	165	170	148	179	209	30	17.0%
Saint Thomas	STT	78	108	125	117	156	173	176	4	2.2%
Madrid	MAD			218	231	222	209	166	-43	-20.6%
Punta Cana	PUJ			95	92	139	134	160	26	19.5%
Nassau	NAS		100	180	134	142	108	139	31	28.8%
Beijing	PEK							136	136	n/a
Praia	RAI		9	121	122	109	104	92	-13	-12.2%
Providenciales	PLS	4	43	39	26	69	52	82	31	59.4%
Montego Bay	MBJ		238	126	52	69	56	73	17	30.9%
Saint Maarten	SXM			39	43	61	61	52	-9	-14.4%
Lisbon	LIS	44		26	26	48	39	39	0	0.0%
Grand Cayman	GCM		31	17		9	26	26	0	0.0%
Terceira	TER	44		17	17	17	17	17	0	0.0%
Puerto Plata	POP	4						9	9	n/a
	UVF							9	9	n/a
	LIR							9	9	n/a
Sao Vicente	VXE			4		4				
Charlottetown	YYG									
Helsinki	HEL									
Milan Malpensa	MXP	366	343							

Table E-4 Logan Airport Scheduled Passenger Departures by Destination (Continued)

Destination Airport	Code	2000	2005	2010	2011	2012	2013	2014	2013-2014 Change	2013-2014 Percent Change
Fredericton	YFC		686							
Quebec	YQB	1,229	30							
Manchester	MAN	26	241							
Glasgow	GLA									
Connaught	NOC									
Stockholm Arlanda	ARN									
Mexico City	MEX		234							
Las Palmas	LPA									
San Salvador	SAL		178							
Vancouver	YVR	366	62							
Ilha Do Sal	SID		56							
Nykoping	NYO		31							
Port Au Prince	PAP									
Lerwick Sumburgh Apt	LSI									
Freeport	FPO									
London Gatwick	LGW	362								
Brussels	BRU	362								
Gander	YQX									
Athens	ATH	74								
Total Scheduled Carrier Operations		233,779	183,520	168,726	171,945	167,435	170,197	173,607	3,410	2.0%

Source: OAG Schedules.

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F

Regional Transportation

This appendix provides detailed tables in support of *Chapter 4, Regional Transportation*:

- Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2014
- Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2014
- Scheduled Passenger Operations by Market and Carrier for New England's Regional Airports
  - Table F-3 Bradley International Airport, Connecticut
  - Table F-4 T.F. Green Airport, Rhode Island
  - Table F-5 Manchester-Boston Regional Airport, New Hampshire
  - Table F-6 Portland International Jetport, Maine
  - Table F-7 Burlington International Airport, Vermont
  - Table F-8 Bangor International Airport, Maine
  - Table F-9 Tweed-New Haven Airport, Connecticut
  - Table F-10 Worcester Regional Airport, Massachusetts
  - Table F-11 Hanscom Field, Massachusetts
  - Table F-12 Portsmouth International Airport, New Hampshire

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Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2014

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2000													
Commercial	132,062	103,750	61,506	47,609	45,745	21,446	5,260	4,029	6,104	6,572	434,083	452,763	886,846
General Aviation[1]	31,863	52,184	45,740	56,571	59,377	34,831	56,200	46,518	31,601	204,512	619,397	35,233	654,630
Military & Other	5,811	2,764	586	2,072	10,241	26,507	328	495	9,973	1,287	60,064	0	60,064
Total	169,736	158,698	107,832	106,252	115,363	82,784	61,788	51,042	47,678	212,371	1,113,544	487,996	1,601,540
2001													
Commercial	128,638	100,606	61,669	47,770	47,261	18,286	4,581	5,631	4,485	6,414	425,341	434,386	859,727
General Aviation[1]	30,478	45,095	44,358	62,014	61,986	35,230	56,092	45,464	30,148	197,770	608,635	28,739	637,374
Military & Other	5,913	2,635	607	2,259	11,821	26,623	437	917	8,221	1,252	60,685	0	60,685
Total	165,029	148,336	106,634	112,043	121,068	80,139	61,110	52,012	42,854	205,436	1,094,661	463,125	1,557,786
2002													
Commercial	113,194	96,595	62,346	45,899	38,929	24,412	3,827	4,062	5,059	6,603	400,926	366,476	767,402
General Aviation[1]	27,838	45,473	29,549	57,720	59,679	35,711	62,163	52,277	28,333	210,221	608,964	25,596	634,560
Military & Other	6,085	2,587	376	2,162	12,167	27,297	593	418	8,220	1,424	61,329	0	61,329
Total	147,117	144,655	92,271	105,781	110,775	87,420	66,583	56,757	41,612	218,248	1,071,219	392,072	1,463,291
2003													
Commercial	103,917	84,301	68,184	42,658	38,293	25,626	3,705	868	4,552	2,956	375,060	344,644	719,704
General Aviation[1]	27,115	42,878	29,552	44,036	50,461	36,706	54,224	55,972	24,866	190,789	556,599	28,660	585,259
Military & Other	4,214	2,496	324	1,449	11,466	32,938	776	378	7,720	1,142	62,903	0	62,903
Total	135,246	129,675	98,060	88,143	100,220	95,270	58,705	57,218	37,138	194,887	994,562	373,304	1,367,866
2004													
Commercial	108,823	83,496	75,360	46,474	41,719	24,970	4,501	0	3,981	4,308	393,632	374,022	767,654
General Aviation[1]	32,269	34,878	27,438	41,547	54,709	29,884	58,881	61,343	25,962	175,301	542,212	31,236	573,448
Military & Other	4,100	346	749	1,338	12,404	29,676	1,010	530	7,797	1,195	59,145	0	59,145
Total	145,192	118,720	103,547	89,359	108,832	84,530	64,392	61,873	37,740	180,804	994,989	405,258	1,400,247
2005													
Commercial	119,048	88,374	76,342	42,661	43,987	25,976	6,137	2,727	3,197	3,627	412,076	377,830	789,906
General Aviation[1]	33,341	28,138	26,369	36,191	49,888	30,016	60,893	62,743	25,446	165,424	518,449	31,236	549,685
Military & Other	3,701	241	479	1,405	11,468	24,154	1,063	519	7,669	904	51,603	0	51,603
Total	156,090	116,753	103,190	80,257	105,343	80,146	68,093	65,989	36,312	169,955	982,128	409,066	1,391,194

Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2014 (Continued)

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2006													
Commercial	111,341	81,282	67,326	38,663	41,342	23,466	5,177	3,793	3,981	3,057	379,428	374,675	754,103
General Aviation[1]	34,548	25,510	25,074	35,572	44,471	29,848	51,702	56,770	25,962	167,560	497,017	31,444	528,461
Military & Other	4,348	229	738	1,536	9,299	22,359	1,157	609	7,797	1,433	49,505	0	49,505
Total	150,237	107,021	93,138	75,771	95,112	75,673	58,036	61,172	37,740	172,050	925,950	406,119	1,332,069
2007													
Commercial	107,097	80,525	69,134	41,450	39,928	22,571	4,594	3,162	4,270	3,477	376,208	370,905	747,113
General Aviation[1]	29,308	22,984	23,959	31,724	47,521	25,542	51,200	61,296	27,000	160,992	481,526	28,632	510,158
Military & Other	5,097	242	644	1,384	9,528	20,949	944	879	8,017	1,438	49,122	0	49,122
Total	141,502	103,751	93,737	74,558	96,977	69,062	56,738	65,337	39,287	165,907	906,856	399,537	1,306,393
2008													
Commercial	98,194	73,096	63,505	40,834	37,832	19,282	4,013	2,553	1,347	104	340,760	347,784	688,544
General Aviation[1]	22,908	19,470	16,198	31,869	46,391	27,143	44,642	43,763	31,051	164,195	447,630	23,820	471,450
Military & Other	3,637	187	840	974	9,688	20,449	243	886	7,993	1,590	46,487	0	46,487
Total	124,739	92,753	80,543	73,677	93,911	66,874	48,898	47,202	40,391	165,889	834,877	371,604	1,206,481
2009													
Commercial	82,021	62,233	54,336	35,909	31,153	16,485	3,096	2,527	422	0	288,182	333,064	621,246
General Aviation[1]	19,586	19,438	14,354	25,473	32,872	19,558	37,722	41,700	25,161	148,696	384,560	12,242	396,802
Military & Other	2,726	260	1,163	778	8,628	16,267	486	17	6,851	1,215	38,391	0	38,391
Total	104,333	81,931	69,853	62,160	72,653	52,310	41,304	44,244	32,434	149,911	711,133	345,306	1,056,439
2010													
Commercial	80,418	60,128	53,971	35,035	29,538	16,190	3,201	1,629	1,516	0	281,626	337,961	619,587
General Aviation[1]	18,759	21,096	13,636	24,776	36,106	20,142	31,884	41,843	25,674	161,942	395,858	14,682	410,540
Military & Other	3,028	347	933	446	4,776	15,525	381	572	7,707	1,795	35,510	0	35,510
Total	102,205	81,571	68,540	60,257	70,420	51,857	35,466	44,044	34,897	163,737	712,994	352,643	1,065,637
2011													
Commercial	86,838	57,194	51,379	35,157	29,166	16,177	3,367	2,017	1,717	750	283,762	340,757	624,519
General Aviation[1]	16,483	21,774	12,497	21,453	42,562	19,503	33,919	44,050	27,056	160,840	400,137	28,230	428,367
Military & Other	3,630	369	874	533	5,890	13,220	310	634	8,158	1,409	35,027	0	35,027
Total	106,951	79,337	64,750	57,143	77,618	48,900	37,596	46,701	36,931	162,999	718,926	368,987	1,087,913

Table F-1 Aircraft Operations by Classification for New England's Airports, 2000 to 2014 (Continued)

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2012													
Commercial	79,704	50,301	45,379	33,118	27,067	14,826	3,936	1,639	502	635	257,107	326,755	583,862
General Aviation[1]	15,589	24,781	12,504	20,864	42,352	18,069	34,775	42,655	30,186	164,841	406,616	28,114	434,730
Military & Other	3,726	434	1,073	584	7,079	11,503	416	740	7,917	738	34,210	0	34,210
Total	99,019	75,516	58,956	54,566	76,498	44,398	39,127	45,034	38,605	166,214	697,933	354,869	1,052,802
2013													
Commercial	78,213	48,340	43,572	31,076	26,814	14,707	4,094	173	560	0	247,549	334,657	582,206
General Aviation[1]	15,192	24,729	11,432	20,021	40,413	15,535	28,794	35,064	28,951	155,469	375,600	26,682	402,282
Military & Other	2,558	435	1,224	471	6,972	11,045	423	593	7,573	612	31,906	0	31,906
Total	95,963	73,504	56,228	51,568	74,199	41,287	33,311	35,830	37,084	156,081	655,055	361,339	1,016,394
2014													
Commercial	78,968	43,888	38,674	29,538	26,057	14,428	4,795	2,521	8,278	0	247,147	337,381	584,528
General Aviation[1]	14,709	16,105	12,293	16,535	40,858	15,466	26,273	28,565	24,440	133,684	328,928	26,416	355,344
Military & Other	2,660	622	908	560	6,842	11,527	529	978	7,621	604	32,851	0	32,851
Total	96,337	60,615	51,875	46,633	73,757	41,421	31,597	32,064	40,339	134,288	608,926	363,797	972,723

1 Includes itinerant and local general aviation (GA) operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.
2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.
3 Operations at Logan Airport include international operations.
Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2014

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2000 to 2001													
Commercial	(2.59%)	(3.03%)	0.27%	0.34%	3.31%	(14.73%)	(12.91%)	39.76%	(26.52%)	(2.40%)	(2.01%)	(4.06%)	(3.06%)
General Aviation[1]	(4.35%)	(13.58%)	(3.02%)	9.62%	4.39%	1.15%	(0.19%)	(2.27%)	(4.60%)	(3.30%)	(1.74%)	(18.43%)	(2.64%)
Military & Other	1.76%	(4.67%)	3.58%	9.03%	15.43%	0.44%	33.23%	85.25%	(17.57%)	(2.72%)	1.03%	-	1.03%
Total	(2.77%)	(6.53%)	(1.11%)	5.45%	4.95%	(3.20%)	(1.10%)	1.90%	(10.12%)	(3.27%)	(1.70%)	(5.10%)	(2.73%)
2001 Percent of Total	10.59%	9.52%	6.85%	7.19%	7.77%	5.14%	3.92%	3.34%	2.75%	13.19%	70.27%	29.73%	100.00%
2001 to 2002													
Commercial	(12.01%)	(3.99%)	1.10%	(3.92%)	(17.63%)	33.50%	(16.46%)	(27.86%)	12.80%	2.95%	(5.74%)	(15.63%)	(10.74%)
General Aviation[1]	(8.66%)	0.84%	(33.39%)	(6.92%)	(3.72%)	1.37%	10.82%	14.99%	(6.02%)	6.30%	0.05%	(10.94%)	(0.44%)
Military & Other	2.91%	(1.82%)	(38.06%)	(4.29%)	2.93%	2.53%	35.70%	(54.42%)	(0.01%)	13.74%	1.06%	-	1.06%
Total	(10.85%)	(2.48%)	(13.47%)	(5.59%)	(8.50%)	9.09%	8.96%	9.12%	(2.90%)	6.24%	(2.14%)	(15.34%)	(6.07%)
2002 Percent of Total	10.05%	9.89%	6.31%	7.23%	7.57%	5.97%	4.55%	3.88%	2.84%	14.91%	73.21%	26.79%	100.00%
2002 to 2003													
Commercial	(8.20%)	(12.73%)	9.36%	(7.06%)	(1.63%)	4.97%	(3.19%)	(78.63%)	(10.02%)	(55.23%)	(6.45%)	(5.96%)	(6.22%)
General Aviation[1]	(2.60%)	(5.71%)	0.01%	(23.71%)	(15.45%)	2.79%	(12.77%)	7.07%	(12.24%)	(9.24%)	(8.60%)	11.97%	(7.77%)
Military & Other	(30.75%)	(3.52%)	(13.83%)	(32.98%)	(5.76%)	20.67%	30.86%	(9.57%)	(6.08%)	(19.80%)	2.57%	-	2.57%
Total	(8.07%)	(10.36%)	6.27%	(16.67%)	(9.53%)	8.98%	(11.83%)	0.81%	(10.75%)	(10.70%)	(7.16%)	(4.79%)	(6.52%)
2003 Percent of Total	9.89%	9.48%	7.17%	6.44%	7.33%	6.96%	4.29%	4.18%	2.72%	14.25%	72.71%	27.29%	100.00%
2003 to 2004													
Commercial	4.72%	(0.95%)	10.52%	8.95%	8.95%	(2.56%)	21.48%	(100.00%)	(12.54%)	45.74%	4.95%	8.52%	6.66%
General Aviation[1]	19.01%	(18.66%)	(7.15%)	(5.65%)	8.42%	(18.59%)	8.59%	9.60%	4.41%	(8.12%)	(2.58%)	8.99%	(2.02%)
Military & Other	(2.71%)	(86.14%)	131.17%	(7.66%)	8.18%	(9.90%)	30.15%	40.21%	1.00%	4.64%	(5.97%)	-	(5.97%)
Total	7.35%	(8.45%)	5.60%	1.38%	8.59%	(11.27%)	9.69%	8.14%	1.62%	(7.23%)	0.04%	8.56%	2.37%
2004 Percent of Total	10.37%	8.48%	7.39%	6.38%	7.77%	6.04%	4.60%	4.42%	2.70%	12.91%	71.06%	28.94%	100.00%
2004 to 2005													
Commercial	9.40%	5.84%	1.30%	(8.20%)	5.44%	4.03%	36.35%	-	(19.69%)	(15.81%)	4.69%	1.02%	2.90%
General Aviation[1]	3.32%	(19.32%)	(3.90%)	(12.89%)	(8.81%)	0.44%	3.42%	2.28%	(1.99%)	(5.63%)	(4.38%)	0.00%	(4.14%)
Military & Other	(9.73%)	(30.35%)	(36.05%)	5.01%	(7.55%)	(18.61%)	5.25%	(2.08%)	(1.64%)	(24.35%)	(12.75%)	-	(12.75%)
Total	7.51%	(1.66%)	(0.34%)	(10.19%)	(3.21%)	(5.19%)	5.75%	6.65%	(3.78%)	(6.00%)	(1.29%)	0.94%	(0.65%)
2005 Percent of Total	11.22%	8.39%	7.42%	5.77%	7.57%	5.76%	4.89%	4.74%	2.61%	12.22%	70.60%	29.40%	100.00%

Table F-2 Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2014 (Continued)

Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2005 to 2006													
Commercial	(6.47%)	(8.02%)	(11.81%)	(9.37%)	(6.01%)	(9.66%)	(15.64%)	39.09%	24.52%	(15.72%)	(7.92%)	(0.84%)	(4.53%)
General Aviation[1]	3.62%	(9.34%)	(4.91%)	(1.71%)	(10.86%)	(0.56%)	(15.09%)	(9.52%)	2.03%	1.29%	(4.13%)	0.67%	(3.86%)
Military & Other	17.48%	(4.98%)	54.07%	9.32%	(18.91%)	(7.43%)	8.84%	17.34%	1.67%	58.52%	(4.07%)	-	(4.07%)
Total	(3.75%)	(8.34%)	(9.74%)	(5.59%)	(9.71%)	(5.58%)	(14.77%)	(7.30%)	3.93%	1.23%	(5.72%)	(0.72%)	(4.25%)
2006 Percent of Total	11.28%	8.03%	6.99%	5.69%	7.14%	5.68%	4.36%	4.59%	2.83%	12.92%	69.51%	30.49%	100.00%
2006 to 2007													
Commercial	(3.81%)	(0.93%)	2.69%	7.21%	(3.42%)	(3.81%)	(11.26%)	(16.64%)	7.26%	13.74%	(0.85%)	(1.01%)	(0.93%)
General Aviation[1]	(15.17%)	(9.90%)	(4.45%)	(10.82%)	6.86%	(14.43%)	(0.97%)	7.97%	4.00%	(3.92%)	(3.12%)	(8.94%)	(3.46%)
Military & Other	17.23%	5.68%	(12.74%)	(9.90%)	2.46%	(6.31%)	(18.41%)	44.33%	2.82%	0.35%	(0.77%)	-	(0.77%)
Total	(5.81%)	(3.06%)	0.64%	(1.60%)	1.96%	(8.74%)	(2.24%)	6.81%	4.10%	(3.57%)	(2.06%)	(1.62%)	(1.93%)
2007 Percent of Total	10.83%	7.94%	7.18%	5.71%	7.42%	5.29%	4.34%	5.00%	3.01%	12.70%	69.42%	30.58%	100.00%
2007 to 2008													
Commercial	(8.31%)	(9.23%)	(8.14%)	(1.49%)	(5.25%)	(14.57%)	(12.65%)	(19.26%)	(68.45%)	(97.01%)	(9.42%)	(6.23%)	(7.84%)
General Aviation[1]	(21.84%)	(15.29%)	(32.39%)	0.46%	(2.38%)	6.27%	(12.81%)	(28.60%)	15.00%	1.99%	(7.04%)	(16.81%)	(7.59%)
Military & Other	(28.64%)	(22.73%)	30.43%	(29.62%)	1.68%	(2.39%)	(74.26%)	0.80%	(0.30%)	10.57%	(5.36%)	-	(5.36%)
Total	(11.85%)	(10.60%)	(14.08%)	(1.18%)	(3.16%)	(3.17%)	(13.82%)	(27.76%)	2.81%	(0.01%)	(7.94%)	(6.99%)	(7.65%)
2008 Percent of Total	10.34%	7.69%	6.68%	6.11%	7.78%	5.54%	4.05%	3.91%	3.35%	13.75%	69.20%	30.80%	100.00%
2008 to 2009													
Commercial	(16.47%)	(14.86%)	(14.44%)	(12.06%)	(17.65%)	(14.51%)	(22.85%)	(1.02%)	(68.67%)	(100.00%)	(15.43%)	(4.23%)	(9.77%)
General Aviation[1]	(14.50%)	(0.16%)	(11.38%)	(20.07%)	(29.14%)	(27.94%)	(15.50%)	(4.71%)	(18.97%)	(9.44%)	(14.09%)	(48.61%)	(15.83%)
Military & Other	(25.05%)	39.04%	38.45%	(20.12%)	(10.94%)	(20.45%)	100.00%	(98.08%)	(14.29%)	(23.58%)	(17.42%)	-	(17.42%)
Total	(16.36%)	(11.67%)	(13.27%)	(15.63%)	(22.64%)	(21.78%)	(15.53%)	(6.27%)	(19.70%)	(9.63%)	(14.82%)	(7.08%)	(12.44%)
2009 Percent of Total	9.88%	7.76%	6.61%	5.88%	6.88%	4.95%	3.91%	4.19%	3.07%	14.19%	67.31%	32.69%	100.00%
2009 to 2010													
Commercial	(1.95%)	(3.38%)	(0.67%)	(2.43%)	(5.18%)	(1.79%)	3.39%	(35.54%)	259.24%	-	(2.27%)	1.47%	(0.27%)
General Aviation[1]	(4.22%)	8.53%	(5.00%)	(2.74%)	9.84%	2.99%	(15.48%)	0.34%	2.04%	8.91%	2.94%	19.93%	3.46%
Military & Other	11.08%	33.46%	(19.78%)	(42.67%)	(44.65%)	(4.56%)	(21.60%)	3264.71%	12.49%	47.74%	(7.50%)	-	(7.50%)
Total	(2.04%)	(0.44%)	(1.88%)	(3.06%)	(3.07%)	(0.87%)	(14.13%)	(0.45%)	7.59%	9.22%	0.26%	2.12%	0.87%
2010 Percent of Total	9.59%	7.65%	6.43%	5.65%	6.61%	4.87%	3.33%	4.13%	3.27%	15.37%	66.91%	33.09%	100.00%
2010 to 2011													
Commercial	7.98%	(4.88%)	(4.80%)	0.35%	(1.26%)	(0.08%)	5.19%	23.82%	13.26%	-	0.76%	0.83%	0.80%
General Aviation[1]	(12.13%)	3.21%	(8.35%)	(13.41%)	17.88%	(3.17%)	6.38%	5.27%	5.38%	(0.68%)	1.08%	92.28%	4.34%
Military & Other	19.88%	6.34%	(6.32%)	19.51%	23.32%	(14.85%)	(18.64%)	10.84%	5.85%	(21.50%)	(1.36%)	-	(1.36%)
Total	4.64%	(2.74%)	(5.53%)	(5.17%)	10.22%	(5.70%)	6.01%	6.03%	5.83%	(0.45%)	0.83%	4.63%	2.09%
2011 Percent of Total	9.83%	7.29%	5.95%	5.25%	7.13%	4.49%	3.46%	4.29%	3.39%	14.98%	66.08%	33.92%	100.00%

Table F-2	Percentage Change in Aircraft Operations by Classification for New England's Airports, 2000 to 2014 (Continued)												
Airport	Bradley International	T.F. Green	Manchester-Boston Regional	Portland International Jetport	Burlington	Bangor	Tweed-New Haven	Worcester Regional	Portsmouth International	Hanscom Field[2]	Subtotal	Logan[3]	Total
2011 to 2012													
Commercial	(8.22%)	(12.05%)	(11.68%)	(5.80%)	(7.20%)	(8.35%)	16.90%	(18.74%)	(70.76%)	-	(9.39%)	(4.11%)	(6.51%)
General Aviation[1]	(5.42%)	13.81%	0.06%	(2.75%)	(0.49%)	(7.35%)	2.52%	(3.17%)	11.57%	2.49%	1.62%	(0.41%)	1.49%
Military & Other	2.64%	17.62%	22.77%	9.57%	20.19%	(12.99%)	34.19%	16.72%	(2.95%)	(47.62%)	(2.33%)	NA	(2.33%)
Total	(7.42%)	(4.82%)	(8.95%)	(4.51%)	(1.44%)	(9.21%)	4.07%	(3.57%)	4.53%	1.97%	(2.92%)	(3.83%)	(3.23%)
2012 Percent of Total	9.41%	7.17%	5.60%	5.18%	7.27%	4.22%	3.72%	4.28%	3.67%	15.79%	66.29%	33.71%	100.00%
2012 to 2013													
Commercial	(1.87%)	(3.90%)	(3.98%)	(6.17%)	(0.93%)	(0.80%)	4.01%	(89.44%)	11.55%	-	(3.72%)	2.42%	(0.28%)
General Aviation[1]	(2.55%)	(0.21%)	(8.57%)	(4.04%)	(4.58%)	(14.02%)	(17.20%)	(17.80%)	(4.09%)	(5.69%)	(7.63%)	(5.09%)	(7.46%)
Military & Other	(31.35%)	0.23%	14.07%	(19.35%)	(1.51%)	(3.98%)	1.68%	(19.86%)	(4.35%)	(17.07%)	(6.73%)	NA	(6.73%)
Total	(3.09%)	(2.66%)	(4.63%)	(5.49%)	(3.01%)	(7.01%)	(14.86%)	(20.44%)	(3.94%)	(6.10%)	(6.14%)	1.82%	(3.46%)
2013 Percent of Total	9.44%	7.23%	5.53%	5.07%	7.30%	4.06%	3.28%	3.53%	3.65%	15.36%	64.45%	35.55%	100.00%
2013 to 2014													
Commercial	0.97%	(9.21%)	(11.24%)	(4.95%)	(2.82%)	(1.90%)	17.12%	1357.23%	1378.21%	NA	(0.16%)	0.81%	0.40%
General Aviation[1]	(3.18%)	(34.87%)	7.53%	(17.41%)	1.10%	(0.44%)	(8.76%)	(18.53%)	(15.58%)	(14.01%)	(12.43%)	(1.00%)	(11.67%)
Military & Other	3.99%	42.99%	(25.82%)	18.90%	(1.86%)	4.36%	25.06%	64.92%	0.63%	(1.31%)	2.96%	NA	2.96%
Total	0.39%	(17.54%)	(7.74%)	(9.57%)	(0.60%)	0.32%	(5.15%)	(10.51%)	8.78%	(13.96%)	(7.04%)	0.68%	(4.30%)
2014 Percent of Total	9.90%	6.23%	5.33%	4.79%	7.58%	4.26%	3.25%	3.30%	4.15%	13.81%	62.60%	37.40%	100.00%

1 Includes itinerant and local general aviation (GA) operations at the regional airports. There are no local (touch-and-go training) operations at Logan Airport.
2 Commercial operations at Hanscom Field include scheduled commercial operations only; other air taxi operations counted as GA.
3 Operations at Logan Airport include international operations.
Source: Massport, Federal Aviation Administration (FAA) Tower Counts, and individual airport records.

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Jet Carriers																				
AirTran	Atlanta	ATL						174	912	738	423.3%						20,391	106,704	86,313	423.3%
Alaska	Chicago O'Hare	ORD	30							-	-	4,050							-	-
America West	Columbus	CMH	149							-	-	18,441							-	-
America West	Las Vegas	LAS	210							-	-	27,469							-	-
America West	Phoenix	PHX	275	365						-	-	37,772	54,570						-	-
American	Chicago O'Hare	ORD	2,139	1,570						-	-	304,855	203,929						-	-
American	Dallas/Fort Worth	DFW	1,343	1,052	1,052	1,078	1,068	1,069	1,008	-61	-5.7%	185,922	136,897	160,983	172,457	170,811	171,017	157,952	-13,065	-7.6%
American	Los Angeles	LAX	214					122	243	121	99.2%	31,244					19,520	38,880	19,360	99.2%
American	Miami	MIA	366	365	413	516	366	396	476	80	20.2%	51,427	49,990	63,559	82,560	58,560	63,360	74,981	11,621	18.3%
American	New York J F Kennedy	JFK								-	-								-	-
American	San Juan	SJU	366	365	365	365	91			-	-	69,348	84,425	55,856	58,400	14,560			-	-
American	St. Louis	STL								-	-								-	-
Boston-Maine Airways	Fort Lauderdale/Hollywood	FLL		13						-	-		1,993						-	-
Continental	Cleveland	CLE	582	131						-	-	68,974	16,262						-	-
Continental	Houston Intercontinental	IAH	366	313						-	-	45,790	34,072						-	-
Continental	New York Newark	EWR	331							-	-	38,916							-	-
Delta	Atlanta	ATL	2,192	3,098	2,099	2,094	2,105	2,109	2,391	282	13.4%	392,835	479,098	300,185	310,149	317,331	319,290	355,968	36,678	11.5%
Delta	Boston	BOS	4							-	-	634							-	-
Delta	Cancun	CUN			35	35	17	13	17	4	32.2%			5,470	5,397	2,735	1,973	2,571	598	30.3%
Delta	Cincinnati	CVG	1,464	1,373						-	-	244,837	196,741						-	-
Delta	Detroit	DTW			1,003	658	506	753	1,053	300	39.9%			129,228	91,657	73,117	110,361	145,867	35,506	32.2%
Delta	Fort Lauderdale/Hollywood	FLL	732	673	237	210				-	-	87,108	133,927	33,674	29,280				-	-
Delta	Fort Myers	RSW			99	90				-	-			13,104	12,780				-	-
Delta	Las Vegas	LAS			9					-	-			1,394					-	-
Delta	Los Angeles	LAX		100	83					-	-		19,928	13,257					-	-
Delta	Minneapolis	MSP			758	576	511	549	605	56	10.2%			99,431	79,418	75,291	82,545	87,377	4,832	5.9%
Delta	New York J F Kennedy	JFK	183							-	-	39,894							-	-
Delta	Orlando	MCO	1,838	1,095	704	608		57		-57	-100.0%	218,705	217,905	99,129	88,041		8,514		-8,514	-100.0%
Delta	Salt Lake City	SLC		27						-	-		3,986						-	-
Delta	Tampa	TPA		678	252	120				-	-		134,894	33,625	15,420				-	-
Delta	West Palm Beach	PBI	732	516	283	120				-	-	87,108	102,684	37,536	16,500				-	-
Frontier Airlines	Denver	DEN								-	-								-	-
jetBlue	Washington National	DCA							402	402	-							40,229	40,229	-
jetBlue	Fort Lauderdale/Hollywood	FLL			101	599	627	612	590	-22	-3.6%			15,086	90,231	94,029	91,800	87,836	-3,964	-4.3%
jetBlue	Fort Myers	RSW						61	181	120	196.7%						9,150	27,150	18,000	196.7%
jetBlue	Orlando	MCO			101	730	723	730	747	17	2.3%			15,086	109,860	108,300	109,500	112,071	2,571	2.3%
jetBlue	San Juan	SJU					366	365	405	40	10.9%					54,900	54,793	60,729	5,936	10.8%
jetBlue	Tampa	TPA						61	365	304	498.4%						9,150	44,693	35,543	388.4%
jetBlue	West Palm Beach	PBI					366	365	365	-	0.0%					45,700	54,750	44,907	-9,843	-18.0%
Laker Airways (Bahamas)	Freeport	FPO	39							-	-	5,850							-	-
Midway Airlines	Raleigh/Durham	RDU	683							-	-	69,213							-	-
Midwest/Republic	Milwaukee	MKE	619							-	-	44,455							-	-
Northwest	Amsterdam	AMS								-	-								-	-
Northwest	Detroit	DTW	1,699	1,451						-	-	215,750	192,679						-	-
Northwest	Fort Myers	RSW								-	-								-	-
Northwest	Minneapolis	MSP	1,177	1,042						-	-	135,570	140,194						-	-

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport (Continued)

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Northwest	Orlando	MCO								-	-								-	-
Northwest	Tampa	TPA								-	-								-	-
Northwest	West Palm Beach	PBI								-	-								-	-
Southwest	Atlanta	ATL							174	174	-							24,923	24,923	-
Southwest	Baltimore	BWI	2,841	3,094	2,700	2,708	2,658	2,610	2,448	-162	-6.2%	389,158	423,878	367,534	367,414	362,995	372,650	353,791	-18,859	-5.1%
Southwest	Chicago Midway	MDW	723	953	923	979	964	967	961	-6	-0.6%	99,090	130,541	126,412	133,267	133,533	146,270	142,513	-3,757	-2.6%
Southwest	Denver	DEN			306	365	366	365	374	9	2.5%			41,922	50,005	50,982	54,860	58,570	3,710	6.8%
Southwest	Fort Lauderdale/Hollywood	FLL			70	365	366	348	369	21	6.1%			9,551	50,005	50,272	49,521	53,381	3,860	7.8%
Southwest	Fort Myers	RSW					147	203	216	13	6.3%					20,413	28,917	30,949	2,032	7.0%
Southwest	Las Vegas	LAS	52	365	361	365	270	245	245	-	0.0%	7,163	50,005	49,398	50,005	40,466	34,876	35,035	159	0.5%
Southwest	Nashville	BNA	672	365	361	304				-	-	92,064	50,005	49,398	41,648				-	-
Southwest	Orlando	MCO	375	1,108	1,016	1,003	997	944	975	31	3.3%	51,336	151,816	139,212	137,411	137,843	136,115	140,866	4,751	3.5%
Southwest	Philadelphia	PHL		1,590						-	-		217,850						-	-
Southwest	Tampa	TPA		695	570	656	623	629	656	27	4.2%		95,156	78,129	89,852	85,873	90,219	93,662	3,443	3.8%
Southwest	West Palm Beach	PBI				61				-	-				8,357				-	-
Sunworld International	Philadelphia	PHL								-	-								-	-
Trans World Airlines	Portland (ME)	PWM	305							-	-	43,310							-	-
Trans World Airlines	St. Louis	STL	1,460							-	-	206,109							-	-
United	Chicago O'Hare	ORD	2,034	1,812	1,296	1,077	697	593	800	207	34.9%	299,522	259,437	198,709	159,738	104,725	86,911	112,864	25,953	29.9%
United	Denver	DEN	366							-	-	46,901							-	-
United	New York Newark	EWR						18		-18	-100.0%						2,126		-2,126	-100.0%
United	San Francisco	SFO	366							-	-	45,384							-	-
United	Washington Dulles	IAD	1,455	726	1,192	812	514	180	222	42	23.6%	173,869	81,631	155,750	108,500	66,780	25,418	32,132	6,714	26.4%
US Airways	Baltimore	BWI	488							-	-	41,760							-	-
US Airways	Charlotte	CLT	1,464	2,188	1,588	1,664	1,665	1,734	1,763	29	1.6%	214,719	350,776	228,119	238,508	241,320	255,885	257,645	1,760	0.7%
US Airways	Fort Lauderdale/Hollywood	FLL	366	123						-	-	39,232	15,161						-	-
US Airways	Orlando	MCO	1,098	30						-	-	117,696	3,842						-	-
US Airways	Philadelphia	PHL	2,148	2,102	361	317	340	365	265	-100	-27.4%	310,118	301,242	49,914	44,595	46,989	49,083	29,004	-20,079	-40.9%
US Airways	Phoenix	PHX								-	-								-	-
US Airways	Pittsburgh	PIT	1,800	27						-	-	278,575	3,189						-	-
US Airways	Washington Dulles	IAD	732							-	-	86,376							-	-
US Airways	Washington National	DCA	1,329	1,064	361	365	335	208	103	-105	-50.5%	171,891	141,068	51,434	52,210	46,511	25,610	12,536	-13,074	-51.0%
US Airways	West Palm Beach	PBI	366							-	-	39,232							-	-
USA 3000 Airlines	Cancun	CUN		26						-	-		4,336						-	-
USA 3000 Airlines	Punta Cana	PUJ		13						-	-		2,128						-	-
Subtotal			38,171	30,507	18,695	18,841	16,686	16,845	21,345	4,500	26.7%	5,179,671	4,486,236	2,622,086	2,693,666	2,404,036	2,484,577	2,767,800	283,223	11.4%
Regional/Commuter Carriers																				
Air Canada Express	Montreal Dorval	YUL	1,385	1,038	1,021	986	976	952	996	44	4.6%	19,392	19,475	19,399	18,739	18,549	17,144	17,925	781	4.6%
Air Canada Express	Toronto	YYZ	1,589	1,342	1,287	1,308	1,294	1,295	1,313	18	1.4%	61,991	38,242	36,960	38,342	33,044	28,103	25,102	-3,001	-10.7%
America West Express	Columbus	CMH	450							-	-	22,493							-	-
American Connection	St. Louis	STL		947						-	-		44,356						-	-
American Eagle	Chicago O'Hare	ORD			1,501	1,630	1,613	1,630	1,622	-8	-0.5%			79,594	95,985	80,413	90,663	115,856	25,193	27.8%
American Eagle	New York J F Kennedy	JFK	1,460							-	-	48,166							-	-
American Eagle	Raleigh/Durham	RDU		1,364	257					-	-		54,521	10,774					-	-
American Eagle	St. Louis	STL								-	-								-	-
Continental Connection	Albany	ALB		51						-	-		961						-	-

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport (Continued)

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Continental Connection	Binghamton	BGM								-	-								-	-
Continental Connection	Boston	BOS								-	-								-	-
Continental Connection	Buffalo	BUF	89							-	-	1,683							-	-
Continental Connection	Burlington	BTV	4							-	-	84							-	-
Continental Connection	New York J F Kennedy	JFK								-	-								-	-
Continental Connection	New York Newark	EWR			608	901	782	642	368	-274	-42.7%			22,485	33,353	31,055	27,097	14,537	-12,560	-46.4%
Continental Connection	Philadelphia	PHL								-	-								-	-
Continental Connection	Rochester	ROC	93							-	-	1,767							-	-
Continental Connection	Syracuse	SYR	97							-	-	1,851							-	-
Continental Express	Cleveland	CLE	803	1,102	1,208	1,200	307			-	-	39,357	54,951	60,400	59,979	15,336			-	-
Continental Express	New York Newark	EWR	1,747	1,351	465	258	65			-	-	82,365	67,455	23,264	12,879	3,264			-	-
Delta Connection	Atlanta	ATL				48	9	4	4	0	-6.7%				3,396	647	279	288	9	3.4%
Delta Connection	Cincinnati	CVG			1,218	1,251	902	895	839	-56	-6.3%			61,642	66,559	45,181	44,757	43,557	-1,200	-2.7%
Delta Connection	Cleveland	CLE							170	170	-							11,898	11,898	-
Delta Connection	Columbus	CMH		994						-	-		49,196						-	-
Delta Connection	Detroit	DTW			1,004	1,323	1,429	1,195	659	-536	-44.9%			54,265	82,915	100,525	80,351	45,421	-34,930	-43.5%
Delta Connection	Fort Lauderdale/Hollywood	FLL								-	-								-	-
Delta Connection	Fort Myers	RSW		612						-	-		42,840						-	-
Delta Connection	Minneapolis	MSP			481	814	858	812	738	-74	-9.1%			36,567	61,731	64,643	61,035	55,233	-5,802	-9.5%
Delta Connection	Myrtle Beach	MYR	61							-	-	3,057							-	-
Delta Connection	New York J F Kennedy	JFK			365	304	183			-	-			18,250	15,200	9,216			-	-
Delta Connection	Orlando	MCO							43	43	-							3,156	3,156	-
Delta Connection	Raleigh/Durham	RDU			100	569	454	270	257	-13	-4.8%			6,136	28,436	22,686	13,500	12,850	-650	-4.8%
Delta Connection	Tampa	TPA								-	-								-	-
Delta Connection	Washington National	DCA			166	929	360			-	-			11,324	51,524	18,074			-	-
Delta Connection	West Palm Beach	PBI								-	-								-	-
Frontier Express	Milwaukee	MKE			140	417				-	-			6,313	18,746				-	-
Independence Air	Washington Dulles	IAD		1,966						-	-		98,307						-	-
Midway Airlines	Raleigh/Durham	RDU	1,348							-	-	67,393							-	-
Midwest Connect	Milwaukee	MKE	4	965						-	-	142	30,871						-	-
Northwest Airlink	Detroit	DTW								-	-								-	-
Northwest Airlink	Indianapolis	IND		638						-	-		31,907						-	-
Northwest Airlink	Memphis	MEM								-	-								-	-
Northwest Airlink	Minneapolis	MSP		31						-	-		1,550						-	-
Shuttle America	Albany	ALB	66							-	-	3,286							-	-
Shuttle America	Bedford	BED	233							-	-	11,671							-	-
Shuttle America	Buffalo	BUF	337							-	-	16,857							-	-
Shuttle America	Islip	ISP	27							-	-	1,329							-	-
Shuttle America	Wilmington	ILG	159							-	-	7,936							-	-
Swissair	New York J F Kennedy	JFK	31							-	-	1,023							-	-
Trans World Airlines	New York J F Kennedy	JFK	1,098							-	-	31,842							-	-
United Express	Chicago O'Hare	ORD		691	548	685	1,038	1,045	877	-168	-16.1%		48,370	36,797	43,701	63,807	59,896	47,419	-12,477	-20.8%
United Express	Cleveland	CLE					818	1,127	235	-892	-79.1%					40,409	56,436	11,750	-44,686	-79.2%
United Express	Houston	IAH							96	96	-							7,521	7,521	-
United Express	New York Newark	EWR					499	627	485	-142	-22.7%					22,468	34,243	23,780	-10,463	-30.6%
United Express	Washington Dulles	IAD		1,519	494	889	928	1,280	1,224	-56	-4.4%		84,484	30,270	54,707	59,507	72,861	68,684	-4,177	-5.7%
US Airways Express	Baltimore	BWI	1,185							-	-	43,850							-	-
US Airways Express	Buffalo	BUF	1,032	839						-	-	38,200	28,607						-	-

Table F-3 Scheduled Passenger Operations by Market and Carrier for Bradley International Airport (Continued)

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
US Airways Express	Charlotte	CLT		4	537	452	462	364	366	2	0.4%		221	45,043	37,510	39,235	28,392	28,940	548	1.9%
US Airways Express	New York La Guardia	LGA			139	1,057	364			-	-			5,159	39,098	13,468			-	-
US Airways Express	New York Newark	EWR								-	-								-	-
US Airways Express	Philadelphia	PHL		439	2,404	2,430	2,356	2,260	2,234	-26	-1.2%		27,685	183,838	163,675	151,526	133,663	136,683	3,020	2.3%
US Airways Express	Pittsburgh	PIT		1,646	939	939	941	939	939	0	0.0%		84,598	46,929	46,929	47,057	77,901	67,549	-10,352	-13.3%
US Airways Express	Rochester	ROC	937	574	478					-	-	34,658	19,555	16,242					-	-
US Airways Express	Syracuse	SYR	732	478						-	-	27,084	9,077						-	-
US Airways Express	Washington National	DCA		551	1,334	1,411	1,574	1,825	2,119	294	16.1%		34,454	89,629	89,940	109,321	115,989	141,783	25,794	22.2%
Subtotal			14,968	19,143	16,694	19,799	18,212	17,164	19,612	2,448	14.3%	567,477	871,682	901,282	1,063,342	989,430	942,310	883,960	-58,350	-6.2%
Total			53,139	49,651	35,389	38,640	34,898	34,009	40,957	6,948	20.4%	5,747,148	5,357,918	3,523,368	3,757,008	3,393,466	3,426,886	3,651,760	224,874	6.6%

Source: OAG Schedules.

Note: All Northwest operations included in Delta from 2010 onwards

Table F-4 Scheduled Passenger Operations by Market and Carrier for T.F. Green Airport

			Departures										Departing Seats								
Carrier	Market	Code	2000	2001	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'12-'13 Change	'12-'13 Pct. Change
Jet Carriers																					
American	Chicago O'Hare	ORD	1,464	1,460	1,113						-	-	203,104	143,522						-	-
American	Dallas/Fort Worth	DFW			365						-	-		47,085						-	-
Continental	Cleveland	CLE	569	167	13						-	-	69,771	1,630						-	-
Continental	Houston Intercontinental	IAH	366	243							-	-	45,946							-	-
Continental	New York Newark	EWR	738	1,170	282						-	-	96,448	34,808						-	-
Delta	Atlanta	ATL	1,464	1,460	1,976	510	1,043	990	978	993	15	1.5%	207,888	290,915	72,461	150,526	147,729	145,241	148,012	2,771	1.9%
Delta	Cincinnati	CVG	732	730	695						-	-	103,944	89,235						-	-
Delta	Detroit	DTW				414	58		218	476	258	118.5%			50,065	7,139		30,414	62,046	31,632	104.0%
Delta	Fort Lauderdale/Hollywood	FLL		306							-	-								-	-
Delta	Minneapolis	MSP				74					-	-			9,211					-	-
Delta	Orlando	MCO	732	730							-	-	87,108							-	-
jetBlue	Fort Lauderdale/Hollywood	FLL						31	365	365	-	0.0%					4,650	54,750	54,750	-	0.0%
jetBlue	Orlando	MCO						62	713	713	0	0.1%					9,300	103,786	106,886	3,100	3.0%
Laker Airways (Bahamas)	Freeport	FPO									-	-								-	-
Northwest	Detroit	DTW	1,682	1,631	1,550						-	-	200,509	202,255						-	-
Northwest	Minneapolis	MSP			539						-	-		68,977						-	-
Sata Internacional	Ponta Delgada	PDL									-	-								-	-
Southwest	Baltimore	BWI	3,913	3,877	4,180	3,260	3,043	3,128	3,004	2,820	-184	-6.1%	535,911	572,699	442,637	415,554	433,081	429,658	411,154	-18,504	-4.3%
Southwest	Chicago Midway	MDW	1,072	1,022	1,349	1,135	1,095	1,094	992	975	-17	-1.8%	146,844	184,813	153,121	149,877	150,303	154,633	156,543	1,910	1.2%
Southwest	Denver	DEN						366	304	9	-295	-97.0%					51,110	44,281	1,246	-43,035	-97.2%
Southwest	Fort Lauderdale/Hollywood	FLL	9	30		594	590	500	479	474	-5	-1.0%	1,194		81,378	80,791	68,347	70,413	68,401	-2,012	-2.9%
Southwest	Fort Myers	RSW						86	40	44	4	10.8%					11,743	5,520	6,292	772	14.0%
Southwest	Houston	HOU	152								-	-	20,824							-	-
Southwest	Islip	ISP	608	1,369							-	-	83,237							-	-
Southwest	Kansas City	MCI	366	365	365						-	-	50,142	50,005						-	-
Southwest	Las Vegas	LAS			31	365	365	362			-	-		4,247	50,005	50,005	49,932			-	-
Southwest	Nashville	BNA	706	700	721	296	123				-	-	96,702	98,816	39,578	16,067				-	-
Southwest	Orlando	MCO	955	1,095	1,821	1,799	1,659	1,585	1,423	1,419	-4	-0.3%	130,855	249,418	245,156	225,244	216,998	210,082	204,947	-5,135	-2.4%
Southwest	Philadelphia	PHL			1,773	1,402	1,298				-	-		238,366	192,054	177,001				-	-
Southwest	Phoenix	PHX	366	703	726	361	365				-	-	50,142	99,403	49,398	50,005				-	-
Southwest	Tampa	TPA	745	730	1,086	813	808	763	753	748	-5	-0.6%	102,065	148,821	111,231	109,572	104,140	107,959	107,481	-478	-0.4%
Southwest	West Palm Beach	PBI							31	35	4	12.9%						4,433	5,046	613	13.8%
Spirit Airlines	Detroit	DTW			120						-	-		18,000						-	-
Spirit Airlines	Fort Lauderdale/Hollywood	FLL			568						-	-		84,117						-	-
Spirit Airlines	Fort Myers	RSW			365						-	-		54,750						-	-
United	Chicago O'Hare	ORD	1,477	1,491	1,460	644	626	388	334	320	-14	-4.3%	239,076	200,677	82,802	78,487	48,697	46,258	42,658	-3,600	-7.8%
US Airways	Baltimore	BWI	2,462	2,101							-	-	263,921							-	-
US Airways	Charlotte	CLT	977	1,309	1,858	1,643	1,599	1,726	1,608	1,275	-333	-20.7%	128,984	274,039	233,886	226,854	238,503	225,454	196,644	-28,810	-12.8%
US Airways	Fort Lauderdale/Hollywood	FLL			17						-	-		2,186						-	-
US Airways	Orlando	MCO	52	48	43						-	-	5,605	5,831						-	-
US Airways	Philadelphia	PHL	1,830	1,794	2,182	1,299	1,012	399	313	347	34	10.9%	253,015	312,890	130,008	101,987	39,529	30,973	34,381	3,408	11.0%
US Airways	Pittsburgh	PIT	1,339	1,460	31						-	-	185,109	4,446						-	-
US Airways	Washington National	DCA	1,333	1,147	1,270	365	313	182	124	77	-47	-38.1%	167,278	170,009	49,501	44,006	24,350	14,997	9,566	-5,431	-36.2%
Subtotal			26,108	27,136	26,499	14,974	13,998	11,661	11,677	11,090	-587	-5.0%	3,475,622	3,651,961	1,992,492	1,883,114	1,598,412	1,678,851	1,616,053	-62,798	-3.7%

Table F-4 Scheduled Passenger Operations by Market and Carrier for T.F. Green Airport (Continued)

			Departures										Departing Seats								
Carrier	Market	Code	2000	2001	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'12-'13 Change	'12-'13 Pct. Change
Regional/Commuter Carriers																					
Air Canada Express	Toronto	YYZ	989	991	734	625	591	593	84		-84	-85.8%	37,482	13,783	11,880	11,232	11,262	1,517		-1,517	-100.0%
American Eagle	Chicago O'Hare	ORD									-	-								-	-
American Eagle	Detroit	DTW						12			-	-100.0%					808			-	-
American Eagle	New York J F Kennedy	JFK	1,291	1,404							-	-	42,589							-	-
American Eagle	New York La Guardia	LGA	2,756	1,788							-	-	90,957							-	-
American Eagle	Raleigh/Durham	RDU			343						-	-		13,081						-	-
Cape Air	Block Island	BID								538	538	-							4,846	4,846	-
Cape Air	Hyannis	HYA									-	-								-	-
Cape Air	Martha's Vineyard	MVY	1,762	1,871	1,015	747	672	659	501	285	-216	-23.9%	15,861	9,132	6,722	6,048	5,930	4,513	2,561	-1,952	-43.3%
Cape Air	Nantucket	ACK	2,453	2,653	1,199	681	668	576	501	271	-230	-13.0%	22,073	10,787	6,128	6,012	5,181	4,510	2,438	-2,072	-45.9%
Continental Connection	Albany	ALB		944	51						-	-		961						-	-
Continental Connection	Boston	BOS		51							-	-								-	-
Continental Connection	New York Newark	EWR				427	171	684	517	262	-255	-24.4%			31,630	6,316	28,916	21,608	11,386	-10,222	-47.3%
Continental Connection	Plattsburgh	PLB		22							-	-								-	-
Continental Connection	Washington Dulles	IAD						21		79	79	-100.0%					1,533		3,331	3,331	-
Continental Express	Cleveland	CLE	699	1,190	1,238	1,217	1,079	190			-	-100.0%	34,936	61,900	60,836	53,943	9,507			-	-
Continental Express	New York Newark	EWR	1,482	465	1,455	1,028	1,268	85			-	-100.0%	86,552	71,185	51,407	63,407	4,243			-	-
Delta Connection	Atlanta	ATL			31	724	9	43	70	51	-19	61.3%		1,550	52,959	662	3,279	4,522	3,380	-1,142	-25.3%
Delta Connection	Cincinnati	CVG		275	373	43					-	-		19,109	2,150					-	-
Delta Connection	Detroit	DTW				1,324	1,995	2,054	1,748	871	-877	-14.9%			78,701	111,901	113,630	90,191	45,809	-44,382	-49.2%
Delta Connection	Minneapolis	MSP				347	392	266	240	170	-70	-10.0%			26,192	29,553	20,189	17,380	12,878	-4,502	-25.9%
Delta Connection	New York J F Kennedy	JFK									-	-								-	-
Delta Connection	New York La Guardia	LGA	610	155							-	-	19,520							-	-
Delta Connection	Raleigh/Durham	RDU					131				-	-				6,557				-	-
Delta Connection	Washington National	DCA					685	225			-	-100.0%				34,243	11,271			-	-
Independence Air	Washington Dulles	IAD			1,509						-	-		75,429						-	-
Midway Airlines	Raleigh/Durham	RDU		510							-	-								-	-
Northwest Airlink	Detroit	DTW									-	-								-	-
Northwest Airlink	Minneapolis	MSP		302	31						-	-		1,550						-	-
Swissair	New York J F Kennedy	JFK	31								-	-	1,023							-	-
United Express	Chicago O'Hare	ORD			262	455	375	309	306	325	19	-1.1%		18,330	29,820	24,079	19,900	19,896	19,443	-453	-2.3%
United Express	Cleveland	CLE						695	875	102	-773	25.8%					33,484	43,757	5,100	-38,657	-88.3%
United Express	New York Newark	EWR						577	695	732	37	20.6%					28,009	44,028	46,172	2,144	4.9%
United Express	Washington Dulles	IAD	1,468	1,507	1,716	1,569	1,421	1,136	1,035	952	-83	-8.9%	52,832	85,821	99,719	89,593	71,937	65,632	63,746	-1,886	-2.9%
US Airways Express	Albany	ALB	679								-	-	12,898							-	-
US Airways Express	Boston	BOS	48								-	-	909							-	-
US Airways Express	Charlotte	CLT			18	126	147	65	166	175	9	155.7%		879	10,047	12,035	5,423	12,857	13,971	1,114	8.7%
US Airways Express	Hyannis	HYA									-	-								-	-
US Airways Express	Nantucket	ACK									-	-								-	-
US Airways Express	New York La Guardia	LGA	2,298	2,233	1,669	1,222	957	286			-	-100.0%	84,116	55,077	45,225	33,141	10,582			-	-
US Airways Express	New York Newark	EWR	1,569	1,507							-	-	31,176							-	-
US Airways Express	Philadelphia	PHL	366	365	716	1,526	1,713	2,206	2,347	2,213	-134	6.4%	13,542	45,199	107,790	122,386	152,816	154,401	150,139	-4,262	-2.8%
US Airways Express	Pittsburgh	PIT			1,360						-	-		72,808						-	-
US Airways Express	Plattsburgh	PLB	26								-	-	497							-	-
US Airways Express	Washington National	DCA			482	1,373	1,304	1,479	1,492	1,609	117	0.9%		30,996	92,151	95,527	110,451	107,775	111,183	3,408	3.2%
Subtotal			18,527	18,233	14,200	13,436	13,577	12,161	10,577	8,635	-1,942	-13.0%	546,963	587,576	713,356	706,634	648,351	592,587	496,383	-96,204	-16.2%
Total			44,635	45,369	40,699	28,409	27,575	23,822	22,255	19,725	-2,530	-6.6%	4,022,585	4,239,537	2,705,848	2,589,748	2,246,763	2,271,438	2,112,436	-159,002	-7.0%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-5 Scheduled Passenger Operations by Market and Carrier for Manchester Airport

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Jet Carriers																				
Boston-Maine Airways	Myrtle Beach	MYR								-	-								-	-
Boston-Maine Airways	Portsmouth	PSM								-	-								-	-
Boston-Maine Airways	Sanford	SFB								-	-								-	-
Continental	Cleveland	CLE	130							-	-	16,151							-	-
Continental	New York Newark	EWR	462	286						-	-	62,358	30,953						-	-
Delta	Atlanta	ATL	244	668	275	565	514	463	459	-4	-0.8%	34,648	94,856	39,050	81,600	76,629	69,307	68,468	-839	-1.2%
Delta	Cincinnati	CVG		664						-	-		86,583						-	-
Delta	Detroit	DTW			796					-	-			89,289					-	-
Northwest	Detroit	DTW	1,609	1,399						-	-	194,058	180,879						-	-
Northwest	Minneapolis	MSP		365						-	-		46,933						-	-
Southwest	Baltimore	BWI	2,828	3,850	2,891	2,761	2,775	2,726	2,494	-232	-8.5%	387,397	527,405	393,093	376,945	385,044	387,879	364,979	-22,900	-5.9%
Southwest	Chicago Midway	MDW	706	1,355	1,144	1,244	1,168	1,010	984	-26	-2.6%	96,702	185,481	155,466	169,440	161,822	158,820	157,501	-1,319	-0.8%
Southwest	Denver	DEN				92	366	304		-304	-100.0%				12,604	50,379	43,211		-43,211	-100.0%
Southwest	Fort Lauderdale/Hollywood	FLL			9	9	152	90		-90	-100.0%			1,194	1,194	21,190	12,793		-12,793	-100.0%
Southwest	Kansas City	MCI	366							-	-	50,142							-	-
Southwest	Las Vegas	LAS		365	365	365	122	61	9	-52	-85.2%		50,005	50,005	50,005	16,766	8,723	1,246	-7,477	-85.7%
Southwest	Nashville	BNA	397	730						-	-	54,389	99,879						-	-
Southwest	Orlando	MCO	410	1,468	1,125	977	906	831	752	-79	-9.5%	56,111	201,175	154,145	133,829	125,620	123,873	109,202	-14,671	-11.8%
Southwest	Philadelphia	PHL		1,786	1,411	1,325				-	-		244,356	192,456	180,871				-	-
Southwest	Phoenix	PHX			322	273				-	-			44,114	37,401				-	-
Southwest	Tampa	TPA		1,099	782	629	579	466	470	4	0.9%		150,165	107,173	86,212	79,639	68,120	67,509	-611	-0.9%
United	Chicago O'Hare	ORD	1,403	1,339						-	-	221,523	179,151						-	-
United	Portland (ME)	PWM	57							-	-	7,241							-	-
US Airways	Baltimore	BWI	1,782							-	-	191,078							-	-
US Airways	Charlotte	CLT		1,308	365	51				-	-		178,836	52,560	7,406				-	-
US Airways	Orlando	MCO	52							-	-	5,605							-	-
US Airways	Philadelphia	PHL	1,821	2,021	365	313	187	351		-351	-100.0%	222,331	274,215	33,132	30,973	18,499	34,791		-34,791	-100.0%
US Airways	Pittsburgh	PIT	1,085							-	-	139,837							-	-
US Airways	Washington National	DCA	675	575						-	-	82,085	77,461						-	-
Subtotal			14,026	19,279	9,850	8,604	6,769	6,302	5,168	-1,134	-18.0%	1,821,657	2,608,335	1,311,677	1,168,481	935,588	907,518	768,905	-138,613	-15.3%
Regional/Commuter Carriers																				
Air Canada Express	Montreal Dorval	YUL								-	-								-	-
Air Canada Express	Toronto	YYZ	339	930	707	403				-	-	5,616	17,439	13,441	7,652				-	-
American Eagle	New York La Guardia	LGA	1,833							-	-	60,480							-	-
Boston-Maine Airways	Bangor	BGR								-	-								-	-
Boston-Maine Airways	Martha's Vineyard	MVY								-	-								-	-
Boston-Maine Airways	Nantucket	ACK								-	-								-	-
Boston-Maine Airways	New London/Groton	GON								-	-								-	-
Boston-Maine Airways	Portsmouth	PSM								-	-								-	-
Boston-Maine Airways	Saint John	YSJ								-	-								-	-
Continental Connection	Albany	ALB	80	313						-	-	1,515	5,944						-	-
Continental Connection	New York J F Kennedy	JFK								-	-								-	-
Continental Connection	New York Newark	EWR			141	175	548	246	380	134	54.7%			9,483	6,486	25,658	10,897	17,117	6,220	57.1%
Continental Connection	Plattsburgh	PLB								-	-								-	-
Continental Connection	Rochester	ROC	44							-	-	841							-	-
Continental Connection	Syracuse	SYR	22							-	-	421							-	-
Continental Connection	Westchester County	HPN								-	-								-	-

Table F-5 Scheduled Passenger Operations by Market and Carrier for Manchester Airport (Continued)

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Continental Express	Cleveland	CLE	593	1,186	1,178	926	190			-	-	29,614	58,991	58,921	46,293	9,500			-	-
Continental Express	New York Newark	EWR	1,028	1,165	1,267	1,215	129			-	-	64,944	58,140	63,336	60,764	6,471			-	-
Delta Connection	Atlanta	ATL	488	485	90			51	59	8	16.7%	24,400	26,620	6,300			3,843	4,484	641	16.7%
Delta Connection	Bangor	BGR	244							-	-	12,200							-	-
Delta Connection	Cincinnati	CVG	1,673	735						-	-	83,657	38,426						-	-
Delta Connection	Detroit	DTW			499	1,858	1,609	1,510	1,296	-214	-14.2%			32,795	95,802	80,786	75,507	69,261	-6,246	-8.3%
Delta Connection	New York J F Kennedy	JFK								-	-								-	-
Delta Connection	New York La Guardia	LGA	727	486			586	1,165	1,140	-25	-2.2%	36,357	24,300			31,216	66,132	63,202	-2,930	-4.4%
Independence Air	Washington Dulles	IAD		1,568						-	-		78,379						-	-
Northwest Airlink	Detroit	DTW								-	-								-	-
Northwest Airlink	Minneapolis	MSP		233						-	-		11,664						-	-
United Express	Chicago O'Hare	ORD		31	1,040	983	867	695	857	162	23.3%		2,170	67,675	62,096	45,929	39,114	49,854	10,740	27.5%
United Express	Cleveland	CLE				9	569	740	111	-629	-85.0%				443	26,546	36,986	5,564	-31,422	-85.0%
United Express	New York Newark	EWR					620	874	585	-289	-33.1%					27,919	43,707	27,707	-16,000	-36.6%
United Express	Washington Dulles	IAD		1,760	1,104	658	427	90		-90	-100.0%		90,419	55,951	33,514	20,788	5,444		-5,444	-100.0%
US Airways Express	Boston	BOS								-	-								-	-
US Airways Express	Charlotte	CLT		307	153	318	366	417	496	79	18.8%		21,863	13,146	27,181	31,476	32,885	37,761	4,876	14.8%
US Airways Express	New York La Guardia	LGA	2,583	2,499	1,381	1,269	594			-	-	96,936	86,492	49,420	43,737	21,962			-	-
US Airways Express	Philadelphia	PHL		562	2,116	2,068	2,092	2,004	2,295	291	14.5%		30,239	140,277	135,156	134,567	126,552	149,598	23,046	18.2%
US Airways Express	Pittsburgh	PIT		1,022						-	-		51,107						-	-
US Airways Express	Washington National	DCA		508	1,039	1,043	1,002	1,252	1,198	-54	-4.3%		25,379	81,095	81,683	78,512	84,499	77,065	-7,434	-8.8%
Subtotal			9,655	13,788	10,716	10,925	9,600	9,045	10,431	1,386	15.3%	416,980	627,572	591,840	600,808	541,331	525,567	503,627	-21,940	-4.2%
Total			23,681	33,067	20,566	19,529	16,369	15,347	15,599	252	1.6%	2,238,636	3,235,907	1,903,517	1,769,288	1,476,919	1,433,085	1,272,532	-160,553	-11.2%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-6 Scheduled Passenger Operations by Market and Carrier for Portland International Jetport

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'12-'13 Change	'12-'13 Pct. Change
Jet Carriers																				
AirTran	Atlanta	ATL			92	167				-	-			10,764	19,522				-	-
AirTran	Baltimore	BWI			944	927	1,016	207		-207	-100.0%			112,951	109,024	119,112	24,169		-24,169	-100.0%
AirTran	Orlando	MCO			52	52	13			-	-			6,503	6,355	1,521			-	-
Continental	Cleveland	CLE								-	-								-	-
Continental	New York Newark	EWR								-	-								-	-
Delta	Atlanta	ATL	732	486	424	793	751	737	693	-44	-6.0%	103,944	61,229	60,167	114,597	110,397	109,750	103,571	-6,179	-5.6%
Delta	Cincinnati	CVG	1,089	486						-	-	154,658	69,012						-	-
Delta	New York La Guardia	LGA					184	239	79	-160	-66.9%					24,256	35,374	11,750	-23,624	-66.8%
Independence Air	Washington Dulles	IAD		307						-	-		40,524						-	-
jetBlue	New York J F Kennedy	JFK			1,201	1,323	1,239	1,307	1,332	25	1.9%			128,936	135,379	124,571	130,671	133,200	2,529	1.9%
jetBlue	Orlando	MCO			212	181				-	-			21,214	21,344				-	-
Northwest	Detroit	DTW	523	427						-	-	52,105	42,700						-	-
Southwest	Baltimore	BWI						799	1,084	285	35.7%						112,419	152,939	40,520	36.0%
Southwest	Orlando	MCO							4	4	-							633	633	-
Southwest	Chicago Midway	MDW							9	9	-							1,246	1,246	-
Trans World Airlines	Hartford	BDL	305							-	-	43,310							-	-
United	Chicago O'Hare	ORD	728							-	-	88,996							-	-
United	Manchester	MHT	366							-	-	53,802							-	-
US Airways	Charlotte	CLT			395	352	366	365	374	9	2.5%			48,688	47,130	49,044	45,260	46,341	1,081	2.4%
US Airways	Philadelphia	PHL	1,312	154		217	18		92	92	-	163,051	19,404		21,525	1,895		9,108	9,108	-
US Airways	Pittsburgh	PIT	1,081							-	-	137,472							-	-
US Airways	Washington National	DCA		52						-	-		6,668						-	-
Subtotal			6,135	1,912	3,320	4,013	3,587	3,653	3,667	14	0.4%	797,338	239,537	389,224	474,876	430,796	457,644	458,788	1,144	0.2%
Regional/Commuter Carriers																				
Air Canada Express	Montreal Dorval	YUL	344							-	-	4,734							-	-
Air Canada Express	Toronto	YYZ			481	783	671	97		-97	-100.0%			9,142	14,872	12,749	1,741		-1,741	-100.0%
America West	New York Newark	EWR	52							-	-	2,457							-	-
American Eagle	Boston	BOS	3,804							-	-	125,518							-	-
American Eagle	Chicago O'Hare	ORD								-	-								-	-
American Eagle	New York La Guardia	LGA	2,033							-	-	67,084							-	-
Continental Conenction	Albany	ALB		291						-	-		5,537						-	-
Continental Conenction	Boston	BOS	204	241						-	-	3,871	4,576						-	-
Continental Conenction	New York Newark	EWR			1,426	1,343	69			-	-			105,503	99,361	5,074			-	-
Continental Conenction	Presque Isle	PQI								-	-								-	-
Continental Express	Cleveland	CLE	425	223	188	166				-	-	20,378	11,021	9,400	8,321				-	-
Continental Express	New York Newark	EWR	1,429	1,394	4	83	394			-	-	70,393	69,605	200	4,150	19,686			-	-
Delta Connection	Atlanta	ATL		700	350					-	-		48,440	25,532					-	-
Delta Connection	Boston	BOS		1,153						-	-		57,650						-	-
Delta Connection	Cincinnati	CVG		600						-	-		31,166						-	-
Delta Connection	Detroit	DTW			1,217	1,314	1,264	1,249	1,061	-188	-15.0%			62,320	65,686	64,758	62,436	60,448	-1,988	-3.2%
Delta Connection	New York J F Kennedy	JFK			270					-	-			13,500					-	-
Delta Connection	New York La Guardia	LGA	475	1,095	786	1,034	1,050	1,202	1,231	29	2.4%	15,191	54,750	41,440	57,437	67,453	80,898	80,103	-795	-1.0%
Independence Air	Washington Dulles	IAD		1,384						-	-		69,186						-	-
Lufthansa German Airlines	Washington Dulles	IAD	31							-	-	1,550							-	-
Northwest Airlink	Detroit	DTW	484	915						-	-	33,366	53,132						-	-
Northwest Airlink	Minneapolis	MSP		404						-	-		20,186						-	-

Table F-6 Scheduled Passenger Operations by Market and Carrier for Portland International Jetport (Continued)

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'12-'13 Change	'12-'13 Pct. Change
Starlink Aviation	Yarmouth	YQI			521	521	217			-	-			9,386	9,386	3,909			-	-
Swissair	Boston	BOS	31							-	-	1,023							-	-
United Express	Chicago O'Hare	ORD		1,095	1,249	1,176	1,125	1,045	1,038	-7	-0.6%		67,590	82,273	72,457	59,896	65,872	63,099	-2,773	-4.2%
United Express	Cleveland	CLE				22	249	298		-298	-100.0%					11,906	14,886		-14,886	-100.0%
United Express	New York Newark	EWR					1,133	1,630	1,470	-160	-9.8%					56,694	102,156	92,953	-9,203	-9.0%
United Express	Washington Dulles	IAD	996	1,456	1,078	1,066	885	750	689	-61	-8.2%	49,779	83,730	64,767	62,493	43,839	39,624	37,949	-1,675	-4.2%
US Airways Express	Bangor	BGR	231							-	-	8,558							-	-
US Airways Express	Boston	BOS	2,229							-	-	42,359							-	-
US Airways Express	Charlotte	CLT		365	88	18	31	35	26	-9	-25.1%		23,710	5,323	1,364	2,542	2,777	2,065	-712	-25.6%
US Airways Express	New York La Guardia	LGA	1,218	1,665	1,647	1,526	598			-	-	43,901	77,909	78,477	68,755	26,013			-	-
US Airways Express	Philadelphia	PHL		1,913	1,947	1,987	2,153	2,131	1,986	-145	-6.8%		100,307	133,521	129,133	139,908	137,137	125,325	-11,812	-8.6%
US Airways Express	Pittsburgh	PIT		219						-	-		10,971						-	-
US Airways Express	Plattsburgh	PLB	48							-	-	909							-	-
US Airways Express	Presque Isle	PQI								-	-								-	-
US Airways Express	Washington National	DCA	1,089	1,149	1,043	1,043	1,260	1,408	1,426	18	1.3%	33,976	75,568	83,302	87,190	102,160	100,248	99,757	-491	-0.5%
US Airways Express	Westchester County	HPN	65							-	-	1,235							-	-
Subtotal			15,187	16,261	12,296	12,081	11,098	9,843	10,941	1,098	11.2%	526,282	865,033	724,086	681,682	616,586	607,775	563,713	-44,062	-7.2%
Total			21,322	18,174	15,615	16,094	14,684	13,496	14,608	1,112	8.2%	1,323,619	1,104,570	1,113,310	1,156,558	1,047,382	1,065,419	1,022,501	-42,918	-4.0%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-7 Scheduled Passenger Operations by Market and Carrier for Burlington Airport

Carrier	Market	Code	Departures 2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	Departing Seats 2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Jet Carriers																				
AirTran	Baltimore	BWI								-	-								-	-
Allegiant Air	Sanford	SFB							94	94	-							15,873	15,873	-
Continental	New York Newark	EWR								-	-								-	-
Delta	Atlanta	ATL						153	92	-61	-39.9%						21,394	13,708	-7,686	-35.9%
jetBlue	New York J F Kennedy	JFK	244	1,126	1,434	1,405	1,363	1,365	1,244	-121	-8.8%	39,528	173,920	180,286	163,839	163,821	143,907	124,357	-19,550	-13.6%
jetBlue	Orlando	MCO			330	339	326			-	-			33,014	33,871	32,643			-	-
Northwest	Detroit	DTW		174						-	-		17,429						-	-
United	Chicago O'Hare	ORD	815	365						-	-	105,509	42,379						-	-
United	Portland (ME)	PWM								-	-								-	-
US Airways	Philadelphia	PHL	1,098	365				26	116	90	351.1%	150,338	46,170				2,546	11,470	8,924	350.6%
US Airways	Pittsburgh	PIT	732							-	-	103,568							-	-
US Airways	Washington National	DCA		4						-	-		558						-	-
Subtotal			2,889	2,035	1,764	1,744	1,690	1,543	1,546	3	0.2%	398,943	280,456	213,300	197,710	196,464	167,847	165,408	-2,439	-1.5%
Regional/Commuter Carriers																				
America West	New York Newark	EWR	166							-	-	7,889							-	-
American Eagle	Boston	BOS	3,094							-	-	102,111							-	-
American Eagle	Chicago O'Hare	ORD								-	-								-	-
Continental Connection	Albany	ALB								-	-								-	-
Continental Connection	Boston	BOS	244	634						-	-	4,628	12,054						-	-
Continental Connection	Buffalo	BUF	4							-	-	84							-	-
Continental Connection	Hartford	BDL								-	-								-	-
Continental Connection	New York Newark	EWR			405	975	259			-	-			30,002	72,161	19,166			-	-
Continental Connection	Plattsburgh	PLB	213	367						-	-	4,039	6,970						-	-
Continental Connection	Plattsburgh International	PBG								-	-								-	-
Continental Connection	Poughkeepsie	POU	66							-	-	1,262							-	-
Continental Connection	Washington Dulles	IAD					17			-	-					1,226			-	-
Continental Connection	Westchester County	HPN								-	-								-	-
Continental Express	Cleveland	CLE	322	509	366	348	95			-	-	16,064	25,351	18,286	17,421	4,750			-	-
Continental Express	New York Newark	EWR	1,458	1,455	1,020	450	208			-	-	70,203	72,707	51,000	22,514	10,386			-	-
Continental Express	Westchester County	HPN								-	-								-	-
Delta Connection	Atlanta	ATL		62				61	273	212	347.5%		3,100				4,636	20,701	16,065	346.5%
Delta Connection	Boston	BOS		1,002						-	-		50,100						-	-
Delta Connection	Cincinnati	CVG		1,060						-	-		52,979						-	-
Delta Connection	Detroit	DTW			1,227	1,309	1,282	1,223	1,201	-22	-1.8%			61,417	65,443	64,114	61,224	60,043	-1,181	-1.9%
Delta Connection	New York J F Kennedy	JFK			1,336	1,338	221			-	-			67,071	81,259	14,884			-	-
Delta Connection	New York La Guardia	LGA	355				781	1,279	1,248	-31	-2.4%	11,351				50,144	83,899	82,592	-1,307	-1.6%
Independence Air	Washington Dulles	IAD		1,903						-	-		95,136						-	-
Lufthansa German Airlines	Washington Dulles	IAD	31							-	-	1,550							-	-
Northwest Airlink	Detroit	DTW		1,159						-	-		61,983						-	-
Northwest Airlink	Minneapolis	MSP		61						-	-		3,050						-	-
Porter Airlines	Toronto Island Apt	YTZ				9	31	56	47	-9	-15.9%				620	2,150	3,910	3,308	-602	-15.4%
Swissair	Boston	BOS	31							-	-	1,023							-	-
United Express	Chicago O'Hare	ORD		1,003	1,353	1,565	1,391	1,396	1,402	6	0.4%		59,930	84,431	88,435	81,204	84,669	85,350	681	0.8%
United Express	Cleveland	CLE					236	409	73	-336	-82.2%					10,626	20,464	3,636	-16,828	-82.2%
United Express	New York Newark	EWR					958	1,456	1,281	-175	-12.0%					50,709	85,373	82,670	-2,703	-3.2%

Table F-7 Scheduled Passenger Operations by Market and Carrier for Burlington Airport (Continued)

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
United Express	Washington Dulles	IAD	1,477	1,456	1,130	1,112	984	910	892	-18	-1.9%	73,843	72,786	61,988	69,793	57,439	48,930	50,633	1,703	3.5%
US Airways Express	Boston	BOS	2,404							-	-	48,139							-	-
US Airways Express	Charlotte	CLT								-	-								-	-
US Airways Express	New York La Guardia	LGA	2,074	2,175	1,680	1,487	650			-	-	76,749	80,491	62,144	55,008	24,050			-	-
US Airways Express	Philadelphia	PHL		1,980	1,903	1,956	1,873	1,803	1,823	20	1.1%		97,288	128,140	131,727	121,653	111,615	110,129	-1,486	-1.3%
US Airways Express	Pittsburgh	PIT								-	-								-	-
US Airways Express	Plattsburgh	PLB	2,427							-	-	46,116							-	-
US Airways Express	Poughkeepsie	POU	718							-	-	13,639							-	-
US Airways Express	Saranac Lake	SLK	44							-	-	841							-	-
US Airways Express	Washington National	DCA	988	990	1,043	1,043	1,072	1,347	1,276	-71	-5.3%	31,574	61,458	77,625	82,974	85,623	100,348	89,462	-10,886	-10.8%
US Airways Express	Wilkes-Barre Scranton	AVP	22							-	-	415							-	-
Subtotal			16,138	15,816	11,461	11,593	10,058	9,941	11,530	1,589	16.0%	511,521	755,382	642,104	687,357	598,123	605,069	590,538	-14,531	-2.4%
Total			19,028	17,851	13,225	13,336	11,748	11,484	13,076	1,592	13.9%	910,464	1,035,838	855,404	885,067	794,588	772,916	755,946	-16,970	-2.2%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-8 Scheduled Passenger Operations by Market and Carrier for Bangor Airport

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Jet Carriers																				
Allegiant Air	Punta Gorda	PGD							33	33	-							5,478	5,478	-
Allegiant Air	Sanford	SFB			181	150	156	165	153	-12	-7.3%			27,150	22,500	23,912	27,335	26,536	-799	-2.9%
Allegiant Air	St. Petersburg/Clearwater	PIE			107	93	112	115	119	4	3.5%			16,050	13,950	16,944	19,090	20,501	1,411	7.4%
Pan American Airways	Allentown/Bethlehem	ABE								-	-								-	-
Pan American Airways	Baltimore	BWI								-	-								-	-
Pan American Airways	Pittsburgh	PIT	285							-	-	42,729							-	-
Pan American Airways	Portsmouth	PSM	389							-	-	58,414							-	-
Pan American Airways	Sanford	SFB								-	-								-	-
Subtotal			674	0	288	243	268	280	305	25	8.9%	101,143	0	43,200	36,450	40,856	46,425	52,515	6,090	13.1%
Regional/Commuter Carriers																				
American Eagle	Boston	BOS	4,670	1,530						-	-	154,115	56,594						-	-
American Eagle	New York La Guardia	LGA	382	518						-	-	12,606	19,166						-	-
Boston-Maine Airways	Halifax	YHZ								-	-								-	-
Boston-Maine Airways	Manchester	MHT								-	-								-	-
Boston-Maine Airways	Portsmouth	PSM								-	-								-	-
Boston-Maine Airways	Saint John	YSJ								-	-								-	-
Continental Connection	Albany	ALB		189						-	-		3,583						-	-
Continental Express	New York Newark	EWR		481						-	-		22,698						-	-
Delta Connection	Atlanta	ATL								-	-								-	-
Delta Connection	Boston	BOS		1,416						-	-		70,800						-	-
Delta Connection	Cincinnati	CVG	1,342	1,394						-	-	67,100	82,439						-	-
Delta Connection	Detroit	DTW			975	871	703	706	711	5	0.6%			50,540	54,640	46,260	46,371	47,269	898	1.9%
Delta Connection	New York J F Kennedy	JFK			180					-	-			9,000					-	-
Delta Connection	New York La Guardia	LGA			537	844	1,043	1,153	975	-178	-15.4%			26,958	49,368	62,868	71,955	59,239	-12,716	-17.7%
Northwest Airlink	Boston	BOS	27							-	-	797							-	-
Northwest Airlink	Detroit	DTW		1,012						-	-		55,222						-	-
Northwest Airlink	Minneapolis	MSP		61						-	-		3,050						-	-
Pan American Airways	Portsmouth	PSM								-	-								-	-
Pan American Airways	Saint John	YSJ								-	-								-	-
United Express	Chicago O'Hare	ORD							245	245	-							16,170	16,170	-
US Airways Express	Boston	BOS	1,942							-	-	36,906							-	-
US Airways Express	New York La Guardia	LGA	35	158	1,017	1,230	299			-	-	1,295	7,914	44,051	53,371	14,950			-	-
US Airways Express	Philadelphia	PHL	428	1,179	1,156	1,405	1,543	1,564	1,496	-68	-4.4%	15,836	58,943	68,510	89,548	99,457	101,167	94,849	-6,318	-6.2%
US Airways Express	Pittsburgh	PIT								-	-								-	-
US Airways Express	Portland (ME)	PWM	231							-	-	8,558							-	-
US Airways Express	Presque Isle	PQI	299							-	-	6,224							-	-
US Airways Express	Washington National	DCA			31	52	589	883	791	-92	-10.4%			1,529	2,607	29,464	47,981	41,033	-6,948	-14.5%
Subtotal			9,357	7,937	3,896	4,402	4,178	4,307	4,218	-89	-2.1%	303,436	380,408	200,587	249,535	253,000	267,474	258,560	-8,914	-3.3%
Total			10,031	7,937	4,184	4,645	4,446	4,587	4,523	-64	-1.4%	404,579	380,408	243,787	285,985	293,856	313,899	311,075	-2,824	-0.9%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards
Note: Allegiant stopped reporting to the OAG in 2009, so Allegiant 2009-2011 statistics from the T100 database.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-9 Scheduled Passenger Operations by Market and Carrier for Tweed-New Haven Airport

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Regional/Commuter Carriers																				
Delta Connection	Cincinnati	CVG		1,025						-	-		51,236						-	-
Boston-Maine Airways	Baltimore	BWI								-	-								-	-
Boston-Maine Airways	Bedford	BED								-	-								-	-
Boston-Maine Airways	Elmira/Corning	ELM								-	-								-	-
Boston-Maine Airways	Portsmouth	PSM								-	-								-	-
US Airways Express	Philadelphia	PHL	1,773	1,904	1,608	1,535	1,381	1,399	1,356	-43	-3.1%	65,612	76,208	59,491	56,806	52,972	51,768	50,161	-1,607	-3.1%
US Airways Express	Washington National	DCA	937							-	-	34,658							-	-
Total			2,710	2,929	1,608	1,535	1,381	1,399	1,356	-43	-3.1%	100,270	127,444	59,491	56,806	52,972	51,768	50,161	-1,607	-3.1%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-10 Scheduled Passenger Operations by Market and Carrier for Worcester Regional Airport

			Departures													Departing Seats								
Carrier	Market	Code	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Jet Carriers																								
Allegiant Air	Sanford	SFB			182									-	-								-	-
Boston-Maine Airways	Allentown/Bethlehem	ABE												-	-								-	-
Boston-Maine Airways	Portsmouth	PSM												-	-								-	-
Boston-Maine Airways	Sanford	SFB												-	-								-	-
Direct Air	Myrtle Beach	MYR						63	73	96				-	-			9,782	14,120				-	-
Direct Air	Orlando/Sanford	SFB					17	140	144	148				-	-			21,937	24,339				-	-
Direct Air	Punta Gorda	PGD					17	67	94	105				-	-			14,541	17,287				-	-
Direct Air	West Palm Beach	PBI							13	51				-	-			1,872	7,444				-	-
jetBlue	Fort Lauderdale/Hollywood	FLL										61	365	304	498.4%						6,100	36,500	30,400	498.4%
jetBlue	Orlando	MCO										61	365	304	498.4%						6,100	36,500	30,400	498.4%
Subtotal			0	0	182	0	34	270	324	400	0	122	730	608	498.4%	0	0	48,132	63,190	0	12,200	73,000	60,800	498.4%
Regional/Commuter Carriers																								
American Eagle	Chicago O'Hare	ORD												-	-								-	-
American Eagle	New York J F Kennedy	JFK	552											-	-	18,216							-	-
Delta Connection	Atlanta	ATL	670											-	-	33,500							-	-
US Airways Express	Philadelphia	PHL	1,464											-	-	54,168							-	-
Subtotal			2,686	0	0	0	0	0	0	0	0	0	0	-	-	105,884	0	0	0	0	0	0	-	-
Total			2,686	0	182	0	34	270	324	400	0	122	730	608	498.4%	105,884	0	48,132	63,190	0	12,200	73,000	60,800	498.4%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-11 Scheduled Passenger Operations by Market and Carrier for Hanscom Field

Departures

Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Regional/Commuter Carriers											
Boston-Maine Airways	Elmira/Corning									-	-
Boston-Maine Airways	Hyannis	HYA								-	-
Boston-Maine Airways	Manchester	MHT								-	-
Boston-Maine Airways	Martha's Vineyard	MVY								-	-
Boston-Maine Airways	Nantucket	ACK								-	-
Boston-Maine Airways	New Haven	HVN								-	-
Boston-Maine Airways	New London/Groton	GON		9						-	-
Boston-Maine Airways	Portsmouth	PSM		193						-	-
Boston-Maine Airways	Trenton	TTN		867						-	-
Pan American Airways	Atlantic City Pomona Fielc	ACY								-	-
Pan American Airways	Martha's Vineyard	MVY								-	-
Pan American Airways	New York Newark	EWR								-	-
Pan American Airways	Portsmouth	PSM								-	-
Pan American Airways	Westchester County	HPN								-	-
Shuttle America	Buffalo	BUF	1,119							-	-
Shuttle America	Hartford	BDL	173							-	-
Shuttle America	New York La Guardia	LGA	523							-	-
Shuttle America	Trenton	TTN	2,062							-	-
Streamline	Trenton	TTN				155				-	-
US Airways	Martha's Vineyard	MVY								-	-
US Airways	Nantucket	ACK								-	-
US Airways	New York La Guardia	LGA								-	-
US Airways	Philadelphia	PHL								-	-
US Airways	Trenton	TTN								-	-
US Airways	Westchester County	HPN								-	-
Total			3,876	1,069	0	155	0	0	0	0	-

Departing Seats

Carrier	Market	Code	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Regional/Commuter Carriers															
Boston-Maine Airways	Elmira/Corning				2,366	6,994								-	-
Boston-Maine Airways	Hyannis	HYA												-	-
Boston-Maine Airways	Manchester	MHT												-	-
Boston-Maine Airways	Martha's Vineyard	MVY												-	-
Boston-Maine Airways	Nantucket	ACK												-	-
Boston-Maine Airways	New Haven	HVN				2,029								-	-
Boston-Maine Airways	New London/Groton	GON		159										-	-
Boston-Maine Airways	Portsmouth	PSM		3,482	4,569	3,975	463							-	-
Boston-Maine Airways	Trenton	TTN		15,606	17,859	18,841	463							-	-
Pan American Airways	Atlantic City Pomona Fielc	ACY												-	-
Pan American Airways	Martha's Vineyard	MVY												-	-
Pan American Airways	New York Newark	EWR												-	-
Pan American Airways	Portsmouth	PSM												-	-
Pan American Airways	Westchester County	HPN												-	-
Shuttle America	Buffalo	BUF	55,950											-	-
Shuttle America	Hartford	BDL	8,636											-	-
Shuttle America	New York La Guardia	LGA	26,143											-	-
Shuttle America	Trenton	TTN	103,093											-	-
Streamline	Trenton	TTN								4,650				-	-
US Airways	Martha's Vineyard	MVY												-	-
US Airways	Nantucket	ACK												-	-
US Airways	New York La Guardia	LGA												-	-
US Airways	Philadelphia	PHL												-	-
US Airways	Trenton	TTN												-	-
US Airways	Westchester County	HPN												-	-
Total			193,821	19,247	24,794	31,839	926	0	0	4,650	0	0	0	0	-

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

Table F-12 Scheduled Passenger Operations by Market and Carrier for Portsmouth International Airport

			Departures									Departing Seats								
Carrier	Market	Code	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change	2000	2005	2010	2011	2012	2013	2014	'13-'14 Change	'13-'14 Pct. Change
Jet Carriers																				
Alliegiant Airways	Orlando/Sanford	SFB		35				16	83	67	418.8%		5,229				2,656	14,242	11,586	436.2%
Alliegiant Airways	Punta Gorda	PGD							22	22	-							3,652	3,652	-
Boston-Maine Airways	Fort Lauderdale/Hollywood	FLL		13						-	-		1,993						-	-
Boston-Maine Airways	Hartford	BDL		13						-	-		1,993						-	-
Boston-Maine Airways	Newburgh	SWF		48						-	-		7,179						-	-
Boston-Maine Airways	Sanford	SFB		57						-	-		8,593						-	-
Pan American Airways	Allentown/Bethlehem	ABE	93							-	-	13,950							-	-
Pan American Airways	Bangor	BGR	389							-	-	58,414							-	-
Pan American Airways	Gary	GYY	51							-	-	7,714							-	-
Pan American Airways	Manchester	MHT								-	-								-	-
Pan American Airways	New York Newark	EWR								-	-								-	-
Pan American Airways	Pittsburgh	PIT	261							-	-	39,171							-	-
Pan American Airways	Sanford	SFB	296							-	-	44,400							-	-
Pan American Airways	Santo Domingo	SDQ								-	-								-	-
Pan American Airways	St. Petersburg/Clearwater	PIE								-	-								-	-
Pan American Airways	Worcester	ORH								-	-								-	-
Skybus	Columbus	CMH								-	-								-	-
Skybus	Greensboro	GSO								-	-								-	-
Skybus	Punta Gorda	PGD								-	-								-	-
Skybus	Saint Augustine	UST								-	-								-	-
Subtotal			1,091	167	0	0	0	16	105	89	556.3%	163,650	24,986	0	0	0	2,656	17,894	15,238	573.7%
Regional/Commuter Carriers																				
Boston-Maine Airways	Baltimore	BWI								-	-								-	-
Boston-Maine Airways	Bangor	BGR								-	-								-	-
Boston-Maine Airways	Bedford	BED		171						-	-		3,083						-	-
Boston-Maine Airways	Hyannis	HYA								-	-								-	-
Boston-Maine Airways	Manchester	MHT								-	-								-	-
Boston-Maine Airways	Martha's Vineyard	MVY								-	-								-	-
Boston-Maine Airways	Nantucket	ACK								-	-								-	-
Boston-Maine Airways	New Haven	HVN								-	-								-	-
Boston-Maine Airways	New London/Groton	GON								-	-								-	-
Boston-Maine Airways	Saint John	YSJ								-	-								-	-
Boston-Maine Airways	Trenton	TTN		22						-	-		399						-	-
Boston-Maine Airways	Westchester County	HPN								-	-								-	-
Pan American Airways	Atlantic City Pomona Field	ACY								-	-								-	-
Pan American Airways	Baltimore	BWI								-	-								-	-
Pan American Airways	Bangor	BGR								-	-								-	-
Pan American Airways	Bedford	BED								-	-								-	-
Pan American Airways	Martha's Vineyard	MVY								-	-								-	-
Pan American Airways	Saint John	YSJ								-	-								-	-
Subtotal			0	193	0	0	0	0	0	-	-	0	3,482	0	0	0	0	0	-	-
Total			1,091	360	0	0	0	16	105	89	556.3%	163,650	28,467	0	0	0	2,656	17,894	15,238	573.7%

Source: OAG Schedules.
Note: All Northwest operations included in Delta from 2010 onwards

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G

Ground Access

This appendix provides information in support of *Chapter 5, Ground Access to and from Logan Airport*:

- Table G-1A Logan Express Bus Service Ridership (Annual)
- Table G-1B Logan Express Back Bay Service Ridership (Annual)
- Table G-2 Water Transportation Services Ridership (Annual)
- Table G-3 Massachusetts Bay Transportation Authority (MBTA) Airport Station Passengers
- Table G-4 Annual Taxi Dispatches (Tickets Sold)
- Table G-5 Logan Airport Employee Parking Supply
- Table G-6 Logan Airport Commercial Parking Supply
- Table G-7 2014 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment, and Vehicle Miles Traveled (VMT) Summary
- VISSIM Traffic Roadway Network
- March 2014 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)
- September 2014 Logan Airport Parking Space Inventory, submitted to Massachusetts Department of Environmental Protection (also known as the *Parking Freeze Report*)

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Table G-1A	Logan Express Bus Service Ridership					
	Ridership			Percent Change		
Service Year	Air Passengers	Employees	Total	Air Passengers	Employees	Total
Framingham						
1992	207,847	7,573	215,420	4.3%	21.3%	4.8%
1993	229,064	12,307	241,371	10.2%	62.5%	12.0%
1994	250,342	17,352	267,694	9.3%	41.0%	10.9%
1995	274,754	21,129	295,883	9.8%	21.8%	10.5%
1996	325,665	22,932	348,597	18.5%	8.5%	17.8%
1997	316,306	29,871	346,175	(2.9)%	30.3%	(0.7)%
1998	337,007	33,971	370,978	6.5%	13.7%	7.2%
1999	345,715	31,946	380,661	3.5%	(6.0)%	2.6%
2000	371,560	34,508	406,068	6.6%	8.0%	6.7%
2001	354,521	38,740	393,261	(4.6)%	12.3%	(3.2)%
2002	342,746	42,441	385,187	(3.3)%	8.7%	(2.1)%
2003	310,024	55,979	366,003	(9.5)%	31.9%	(5.0)%
2004	323,931	54,763	378,694	4.5%	(2.2%)	3.5%
2005	318,125	57,569	375,694	(1.8%)	5.1%	(0.8%)
2006	349,022	60,764	409,789	9.7%	5.5%	9.1%
2007	311,299	57,252	368,551	(2.1%)[5]	(0.6%)[5]	(1.9%)[5]
2008	276,112	57,797	333,909	(11.3%)	1.0%	(9.4%)
2009	264,233	59,840	324,073	(4.3%)	3.5%	(2.9%)
2010	272,190	62,226	334,416	3.0%	4.0%	3.2%
2011[1]	272,301	68,228	340,529	0.0%	9.6%	1.8%
2012	279,603	82,951	362,554	2.7%	21.6%	6.5%
2013	295,654	84,008	379,662	5.7%	1.3%	4.7%
2014	**303,646**	**87,488**	**391,134**	**2.7%**	**4.1%**	**3.0%**

Table G-1A Logan Express Bus Service Ridership (Continued)

	Ridership			Percent Change		
Service Year	**Air Passengers**	**Employees**	**Total**	**Air Passengers**	**Employees**	**Total**
Braintree						
1992	186,217	9,694	195,911	10.6%	16.6%	10.8%
1993	205,209	22,768	227,977	10.2%	134.9%	16.4%
1994	247,636	37,489	285,125	20.7%	64.7%	25.1%
1995	264,579	70,723	335,302	6.8%	88.7%	17.6%
1996	335,232	103,519	438,751	26.7%	46.4%	30.1%
1997	300,006	135,340	435,346	(10.5)%	30.7%	(0.8)%
1998	300,005	156,105	456,110	0.0%	15.3%	4.8%
1999	328,818	125,286	454,105	9.6%	(19.7)%	(0.5)%
2000	355,932	149,687	505,619	8.2%	19.5%	11.3%
2001	345,249	156,240	501,489	(3.0)%	4.4%	(0.8)%
2002	323,115	190,360	513,475	(6.4)%	21.8%	2.4%
2003	301,013	216,765	517,778	(6.8)%	13.9%	0.8%
2004	318,100	208,566	526,666	5.7%	(3.8%)	1.7%
2005	307,659	189,531	497,190	(3.2%)	(9.1%)	(5.5%)
2006	333,413	202,983	536,396	8.4%	7.1%	7.9%
2007	300,715	196,955	497,670	(2.3%)[5]	3.9%[5]	0.1%[5]
2008	252,289	221,591	473,880	(16.1%)	12.5%	(4.8%)
2009	231,151	234,908	466,059	(8.4%)	6.0%	(1.7%)
2010	231,422	251,443	482,865	0.1%	7.0%	3.6%
2011[1]	233,521	285,515	519,036	0.9%	13.6%	7.5%
2012	247,346	314,542	561,888	5.9%	10.2%	8.3%
2013	268,154	320,329	588,483	8.4%	1.8%	4.7%
2014	**296,975**	**313,334**	**610,309**	**10.7%**	**(2.2%)**	**3.7%**

Table G-1A Logan Express Bus Service Ridership (Continued)

	Ridership			Percent Change		
Service Year	Air Passengers	Employees	Total	Air Passengers	Employees	Total
Woburn[2]						
1992[3]	3,052	91	3,143	NA	NA	-
1993	59,635	5,027	64,662	NA	NA	-
1994	119,567	9,082	128,649	100.5%	80.7%	99.0%
1995	150,147	13,376	163,523	25.6%	47.3%	27.1%
1996	190,566	17,322	207,888	26.9%	29.5%	27.1%
1997	199,715	20,018	219,733	4.8%	15.6%	5.7%
1998	208,286	22,876	231,162	4.3%	14.3%	5.2%
1999	191,454	23,495	214,949	(8.1)%	2.7%	(7.0)%
2000	195,744	27,522	223,266	2.2%	17.1%	3.9%
2001	177,375	38,318	215,530	(9.4)%	39.2%	(3.4)%
2002	161,145	73,277	234,422	(9.2)%	91.0%	8.7%
2003	164,980	103,963	268,943	(2.4)%	41.9%	14.7%
2004	172,110	111,326	283,436	4.3%	7.1%	5.4%
2005	163,227	110,961	274,188	(5.1%)	(0.3%)	(3.2%)
2006	167,341	121,672	289,013	2.5%	9.7%	5.4%
2007	149,149	123,066	272,215	(8.6%)[5]	10.9%[5]	(0.7%)[5]
2008	129,385	122,777	252,162	(13.3%)	(0.2%)	(7.4%)
2009	113,607	121,633	235,240	(12.2%)	(0.9%)	(6.7%)
2010	115,257	127,120	242,377	1.5%	4.5%	3.0%
2011[1]	118,232	151,029	269,261	2.6%	18.8%	11.1%
2012	126,549	188,747	315,296	7.0%	25.0%	17.1%
2013	140,407	192,289	332,696	11.0%	1.9%	5.5%
2014	**156,045**	**194,341**	**350,386**	**11.1%**	**1.1%**	**5.3%**
Peabody						
2001[4]	8,151	3,097	11,248	NA	NA	NA
2002	28,626	20,629	49,255	NA	NA	NA
2003	32,318	23,425	55,743	21.4%	13.6%	13.2%
2004	43,389	33,642	77,031	34.3%	43.6%	38.2%
2005	51,023	39,599	87,622	17.6%	17.7%	13.7%
2006	42,142	32,632	74,774	(17.4%)	(17.6%)	(14.7%)
2007	36,367	26,949	63,316	(28.7%)[5]	(31.9%)[5]	(27.7%)[5]
2008	30,887	30,596	61,483	(15.1%)	13.5%	(2.9%)
2009	27,856	32,220	60,076	(9.8%)	5.3%	(2.3%)
2010	25,543	26,231	51,744	(8.3%)	(18.6%)	(13.8%)
2011[1]	25,555	31,741	57,296	0.0%	21.0%	10.7%
2012	27,542	37,909	65,451	7.8%	19.4%	14.2%
2013	28,790	38,067	66,857	4.5%	0.4%	2.1%
2014	**31,485**	**36,848**	**68,333**	**9.4%**	**(3.2%)**	**2.2%**

Table G-1A Logan Express Bus Service Ridership (Continued)

	Ridership			Percent Change		
Service Year	Air Passengers	Employees	Total	Air Passengers	Employees	Total
Total System Ridership						
1992	397,116	17,358	414,474	8.0%	19.2%	8.5%
1993	493,908	39,832	533,740	24.4%	129.5%	28.8%
1994	617,545	63,923	681,468	25.0%	60.5%	27.7%
1995	689,480	105,228	794,708	11.6%	64.6%	16.6%
1996	851,463	143,773	995,236	23.4%	36.6%	25.2%
1997	816,015	185,229	1,001,254	(4.2)%	28.8%	0.6%
1998	845,598	212,952	1,058,550	3.6%	15.0%	5.7%
1999	868,987	180,727	1,049,714	2.7%	(15.2)%	(0.8)%
2000	923,236	211,717	1,134,953	6.2%	17.1%	8.1%
2001	885,296	236,395	1,121,691	(4.1)%	11.7%	(1.2)%
2002	855,632	326,707	1,182,339	(3.4)%	38.2%	5.4%
2003	808,335	400,132	1,208,467	(5.5%)	22.5%	2.2%
2004	857,530	408,297	1,265,827	6.1%	2.0%	2.2%
2005	837,034	397,660	1,234,694	(2.4%)	(2.6%)	(2.4%)
2006	891,918	418,051	1,309,969	6.6%	5.1%	6.1%
2007	797,530	404,222	1,201,752	(4.7%)[5]	1.7%[5]	(2.7%)[5]
2008	688,673	432,761	1,121,434	(13.6%)	7.1%	(6.7%)
2009	636,847	448,601	1,085,448	(7.5%)	3.7%	(3.2%)
2010	644,412	467,020	1,111,432	1.2%	4.1%	2.4%
2011[1]	649,609	536,513	1,186,122	0.8%	14.9%	6.7%
2012	681,040	624,149	1,305,189	4.8%	16.3%	10.0%
2013	733,005	634,693	1,367,698	8.0%	2.0%	5.0%
2014	**788,151**	**632,011**	**1,420,162**	**7.5%**	**(0.4%)**	**3.8%**

NA Not applicable.
Notes: Jan. 23, 2008: I-90/Ted Williams Tunnel opens to all traffic. The last toll increase for Ted Williams Tunnel was Jan. 1, 2008.
1 Changes to employee parking and bus fares were implemented in October 2011.
2 Woburn Express moved from Mishawum Station to the Anderson Regional Transportation Center (ARTC) in Woburn in May 2001.
3 Reflects a partial year of operation; Woburn Logan Express service was implemented in November 1992.
4 Reflects a partial year of operation. The Peabody Logan Express service commenced in September 2001.
5 Percent comparison between 2007 and 2005. The I-90 Ted Williams Tunnel closures in 2006 resulted in atypical ridership.

Table G-1B Logan Express Back Bay Service Ridership[1]

Service Year	Ridership	Percent Change
2014	**152,892**	**NA**

1 Back Bay Logan Express service commenced in April 2014. Only total ridership available.

Table G-2 Water Transportation Services Ridership to and from Logan Airport

	Rowes Wharf/Fan Pier Water Shuttle	Private Water Taxi (on-demand)[1]	Harbor Express (Long Wharf/Quincy/Hull)	Boston-Logan Water Shuttle (Long Wharf)	Total
1990	181,530	NS	NS	NS	181,530
1991	142,500	NS	NS	NS	142,500
1992	133,297	NS	NS	NS	133,297
1993	159,525	NS	NS	NS	159,525
1994	209,057	NS	NS	NS	209,057
1995	203,829	NS	NS	NS	203,829
1996	159,992	3,364	11,781	NS	175,137
1997	132,542	6,299	71,309	NS	210,150
1998	124,836	9,243	101,174	NS	235,253
1999	122,211	17,252	98,539	NS	238,002
2000	128,097	26,335	83,243	NS	237,675
2001	107,400	29,642	82,704	NS	219,746
2002	75,304	36,736	66,471	NS	178,511
2003	26,480[2]	35,724[3]	61,849	5,722[4]	129,775
2004	NS	54,540	58,788	3,202[5]	116,530
2005	NS	44,975	51,960	NS	96,935
2006	NS	63,639	70,998	NS	134,637
2007	NS	50,737	59,460	NS	110,197
2008	NS	48,630	48,003	NS	96,633
2009	NS	50,734	37,861	NS	88,595
2010	NS	54,382	34,794	NS	89,176
2011	NS	58,879	33,403	NS	92,282
2012	NS	60,840	31,197	NS	92,037
2013	NS	70,378	NA	NS	70,378
2014	**NS**	**67,479**	**NA**	**NS**	**67,479**

Note: Figures from 2003 – 2007 have been revised from previous documents.
1 Operates April-October only.
2 Rowes Wharf Water Shuttle operated from January to June only in 2003.
3 Operated from May to October only in 2003.
4 Long Wharf Boston-Logan Water Shuttle operated from August to December in 2003.
5 Joint operation with City Water Taxi began on August 16, 2003.
NA Data not available.
NS Operation not in service.

Table G-3 Massachusetts Bay Transportation Authority (MBTA) Airport Station Passengers

Year	Entrances	Exits	Total Turnstile Count[1]	Percent Change
1990	NA	NA	2,854,317	-
1991	NA	NA	2,515,293	(11.9)%
1992	NA	NA	2,626,572	4.2%
1993	NA	NA	2,604,980	(0.8)%
1994	NA	NA	3,108,734	19.3%
1995	NA	NA	3,040,868	(2.2)%
1996	NA	NA	2,974,850	(2.2)%
1997[2]	NA	NA	2,774,268	(6.7)%
1998	NA	NA	2,850,367	2.7%
1999	NA	NA	2,974,045	4.3%
2000	NA	NA	3,019,086	1.5%
2001	NA	NA	2,896,638	(4.1)%
2002	NA	NA	2,670,594	(7.8)%
2003[3]	1,300,272	1,275,627	2,575,899	(3.6)%
2004	1,373,861	1,366,511	2,740,372	6.4%
2005	NA	NA	NA	NA
2006	NA	NA	NA	NA
2007[4]	1,412,055	--	2,524,079	--
2008[4]	2,212,111	--	3,647,394	56.7%
2009	2,329,370	--	3,750,549	5.3%
2010	2,270,241	--	3,629,193	(2.5%)
2011	2,277,311	NA	NA	0.3%
2012	2,442,085	NA	NA	7.2%
2013	2,597,306	NA	NA	6.3%
2014	**2,378,965**	**NA**	**NA**	**(8.4%)[6]**

Source: MBTA.

Note: Turnstile counts include both Logan Airport bound (turnstile exits) and non-Logan Airport bound (turnstile entrances) passengers.

1 As stated in the *Logan Airport 1999 ESPR*, Massport believes that ridership estimates through 2005 from the old Airport Station were actually understated because many travelers that were destined for the Airport with baggage had been observed to avoid the turnstiles and exit the old Airport Station via the wide gate (designed for handicapped access) that did not have the capability to count passengers.

2 Airport Station was closed on six weekends during September and October 1997 due to construction.

3 Airport Station was closed on eight weekend days during 2003.

4 Automated fare collection and new fare gates implemented beginning January 2007. Station access to Bremen Street Park opened June 2007. Exits are undercounted.

5 Exits are undercounted, as some exits occur through exit doors rather than turnstiles.

6 Due to the closure of Government Center Station in 2014, it is possible that passengers who would normally take the Blue Line to the Green Line have switched to alternate modes for their trip.

NA Data not available

Table G-4 Annual Taxi Dispatches (Tickets Sold)

Year	Total[1]	Percent Change
1990	1,330,418	
1991	1,208,611	(9.2)%
1992	1,266,033	4.8%
1993	1,336,603	5.6%
1994	1,409,505	5.5%
1995	1,499,869	6.4%
1996	1,721,093	14.7%
1997	1,827,244	6.2%
1998	1,888,281	3.3%
1999	1,955,895	3.6%
2000	2,140,724	9.4%
2001	1,789,736	(16.4)%
2002	1,679,508	(6.2)%
2003	1,562,076	(7.0)%
2004	1,713,696	9.7%
2005	1,769,876	3.3%
2006	1,857,609	5.0%
2007	1,925,817	3.7%
2008	1,749,730	(9.1)%
2009	1,630,333	(6.8)%
2010	1,829,961	12.1%
2011	1,937,743	6.0%
2012	2,022,239	4.4%
2013	2,131,371	5.0%
2014	**2,237,793**	**5.0%**

1 Represents yearly total of tickets sold

Table G-5 Logan Airport Employee Parking Supply

Location	Number of Spaces			
	March 2013	September 2013	**March 2014**	**September 2014**
Terminal Area	879	879	**857**	**868**
North Service Area	966	964	**883**	**883**
Southwest Service Area	0	0	**4**	**4**
South Service Area	808	808	**681**	**681**
Airside (Fire/Rescue)	5	5	**0**	**0**
Total spaces in service	**2,658**	**2,656**	**2,425**	**2,436**
Total spaces out of service	**15**	**17**	**248**	**237**
Total employee spaces	**2,673**	**2,673**	**2,673**	**2,673**

Source: Logan Airport Parking Space Inventory submitted to Massachusetts Department of Environmental Protection (MassDEP), March and September 2013 and 2014.
Note: As of June 2013, the Logan Airport Parking Freeze sets a limit of 18,415 commercial spaces and 2,673 employee spaces at the Airport.

Table G-6 Logan Airport Commercial Parking Supply

Location	Number of Spaces			
	March 2013	September 2013	**March 2014**	**September 2014**
Terminal Area				
Central Garage and West Garage	10,396	10,396	**10,267**	**10,267**
Terminal B Garage	2,553	2,553	**2,254**	**2,254**
Terminal E Lot 1	269	269	**275**	**275**
Terminal E Lot 2	251	251	**248**	**248**
Terminal E Lot 3 (Gulf Lot)	222	222	**219**	**219**
Signature (General Aviation)	35	35	**35**	**35**
Logan Airport Hilton	235	235	**235**	**235**
North Service Area				
Economy Garage	2,809	2,809	**2,809**	**2,809**
Overflow Green Lot (Wood Island)	0	0	**0**	**0**
South Service Area				
Harborside Hyatt Conference Center and Hotel	270	270	**270**	**270**
Overflow Blue Lot (Harborside Dr.)	0	0	**0**	**0**
Southwest Service Area				
Overflow Red Lot (Tomahawk Dr.)	0	0	**0**	**0**
Total spaces in service	17,040	17,040	**16,612**	**16,612**
Total spaces out of service	1,225	1,375	**1,803**	**1,803**
Total commercial spaces	18,265	18,415	**18,415**	**18,415**

Source: Logan Airport Parking Space Inventory submitted to MassDEP, March and September 2013 and 2014.
Note: Logan Airport Parking Freeze sets a limit of 21,088 spaces on Airport. As of June 2013, the allocation is 18,415 commercial and 2,673 employee spaces.

Table G-7 2014 Existing Conditions - Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME AM Peak	VOLUME PM Peak	VOLUME High 8-Hour	VOLUME AWDT	VMT AM Peak	VMT PM Peak	VMT High 8-Hour	VMT AWDT
1	344	25	895	1,109	7,830	17,386	58.32	72.26	510.22	1,132.91
2	496	27	630	781	5,514	12,244	59.18	73.36	517.95	1,150.12
3	1,347	21	499	618	4,364	9,688	127.31	157.67	1,113.37	2,471.65
4	1,166	27	871	1,079	7,619	16,916	192.33	238.26	1,682.41	3,735.36
5	378	25	1,370	1,698	11,989	26,620	98.14	121.64	858.87	1,907.00
6	441	30	532	659	4,653	10,331	44.45	55.06	388.75	863.13
7	896	24	834	1,034	7,301	16,210	141.59	175.55	1,239.51	2,752.03
8	644	28	1,061	1,315	9,285	20,615	129.51	160.51	1,133.34	2,516.29
9	1,214	23	352	436	3,078	6,835	80.92	100.22	707.55	1,571.18
10	1,303	25	775	960	6,778	15,050	191.30	236.97	1,673.08	3,714.94
11	421	19	472	585	4,131	9,171	37.64	46.65	329.42	731.33
12	236	26	45	56	395	878	2.01	2.50	17.63	39.19
13	1,311	26	69	85	600	1,333	17.13	21.10	148.94	330.89
14	750	24	1,524	1,889	13,338	29,614	216.48	268.33	1,894.65	4,206.63
15	441	25	1,113	1,379	9,737	21,619	92.93	115.14	813.02	1,805.14
16	1,724	22	23	29	205	455	7.51	9.47	66.94	148.57
17	644	16	517	641	4,526	10,049	63.01	78.13	551.64	1,224.80
18	354	27	708	877	6,192	13,749	47.48	58.81	415.24	922.02
19	687	17	70	87	614	1,364	9.10	11.31	79.83	177.35
20	94	14	530	657	4,639	10,300	9.45	11.72	82.72	183.67
21	877	6	31	38	268	596	5.15	6.31	44.53	99.04
22	79	28	31	39	275	611	0.46	0.58	4.10	9.10
23	81	29	23	29	205	455	0.35	0.44	3.13	6.94
24	79	5	24	30	212	470	0.36	0.45	3.19	7.07
25	87	9	32	40	282	627	0.53	0.66	4.63	10.30
26	209	7	32	40	282	627	1.27	1.59	11.19	24.87
27	187	5	23	29	205	455	0.81	1.03	7.26	16.12
28	124	5	56	70	494	1,097	1.32	1.65	11.63	25.83
29	226	30	376	466	3,290	7,306	16.10	19.95	140.84	312.75
30	1,070	5	430	533	3,763	8,356	87.10	107.97	762.25	1,692.62
31	385	32	314	389	2,747	6,098	22.88	28.34	200.13	444.26
32	516	25	61	76	537	1,191	5.96	7.43	52.49	116.41
34	181	22	330	409	2,888	6,412	11.29	13.99	98.81	219.39
35	248	25	391	485	3,424	7,603	18.35	22.77	160.72	356.88
36	89	20	330	409	2,888	6,412	5.56	6.89	48.62	107.94
37	102	25	61	76	537	1,191	1.18	1.47	10.42	23.11
38	110	31	98	122	861	1,913	2.04	2.54	17.92	39.82
39	219	32	26	32	226	502	1.08	1.33	9.37	20.80
40	232	11	33	41	289	643	1.45	1.80	12.70	28.25
41	177	28	6	8	56	125	0.20	0.27	1.88	4.19
42	205	30	9	11	78	172	0.35	0.43	3.02	6.67
43	597	25	27	33	233	517	3.06	3.73	26.37	58.50
44	587	31	59	73	515	1,144	6.56	8.11	57.25	127.17
45	96	32	59	73	515	1,144	1.07	1.33	9.37	20.81
46	112	14	5	6	42	94	0.11	0.13	0.89	2.00
47	859	23	5	6	42	94	0.81	0.98	6.83	15.28
48	94	16	272	337	2,379	5,283	4.83	5.98	42.21	93.73
49	420	26	275	341	2,408	5,346	21.90	27.15	191.75	425.71
50	353	33	25	31	219	486	1.67	2.07	14.63	32.46
51	717	26	299	371	2,620	5,816	40.59	50.37	355.68	789.57
52	403	32	261	323	2,281	5,064	19.93	24.66	174.15	386.63
53	321	27	5	6	42	94	0.30	0.36	2.55	5.71
54	612	31	265	329	2,323	5,158	30.71	38.12	269.19	597.71

Table G-7 2014 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

			VOLUME				VMT			
Link Name	Link Distance (ft)	Link Speed (mph)	AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
55	194	26	466	577	4,074	9,046	17.09	21.17	149.45	331.84
56	101	5	0	0	0	0	0.00	0.00	0.00	0.00
57	97	32	124	154	1,087	2,414	2.29	2.84	20.04	44.50
58	103	5	0	0	0	0	0.00	0.00	0.00	0.00
59	105	5	0	0	0	0	0.00	0.00	0.00	0.00
60	331	26	590	731	5,161	11,460	36.93	45.76	323.05	717.34
61	224	8	129	160	1,130	2,508	5.46	6.77	47.83	106.16
62	218	23	209	259	1,829	4,060	8.65	10.72	75.68	168.00
63	242	23	41	51	360	800	1.88	2.34	16.51	36.70
64	232	5	41	51	360	800	1.80	2.24	15.85	35.21
65	593	26	670	830	5,860	13,012	75.29	93.27	658.48	1,462.13
66	465	25	16	20	141	314	1.41	1.76	12.41	27.63
67	483	22	10	12	85	188	0.92	1.10	7.78	17.21
68	487	5	0	0	0	0	0.00	0.00	0.00	0.00
69	361	14	31	38	268	596	2.12	2.60	18.32	40.74
90	582	5	431	534	3,770	8,372	47.52	58.87	415.64	923.00
103	85	33	14	17	120	267	0.22	0.27	1.93	4.29
104	85	5	0	0	0	0	0.00	0.00	0.00	0.00
105	95	5	0	0	0	0	0.00	0.00	0.00	0.00
106	95	5	0	0	0	0	0.00	0.00	0.00	0.00
107	260	18	123	152	1,073	2,383	6.06	7.49	52.89	117.46
108	389	20	83	103	727	1,615	6.11	7.59	53.55	118.95
109	114	14	29	36	254	564	0.63	0.78	5.49	12.18
110	169	16	28	35	247	549	0.89	1.12	7.89	17.54
111	261	5	0	0	0	0	0.00	0.00	0.00	0.00
112	237	28	17	21	148	329	0.76	0.94	6.65	14.79
113	565	17	29	36	254	564	3.11	3.86	27.20	60.40
114	609	32	20	25	177	392	2.31	2.88	20.41	45.20
115	451	28	265	329	2,323	5,158	22.64	28.10	198.42	440.58
116	399	20	29	36	254	564	2.19	2.72	19.19	42.62
117	283	20	44	54	381	847	2.36	2.90	20.43	45.42
118	295	28	275	341	2,408	5,346	15.36	19.04	134.47	298.53
119	240	14	199	247	1,744	3,872	9.05	11.23	79.29	176.04
120	365	28	56	69	487	1,082	3.87	4.77	33.68	74.83
121	356	15	86	107	755	1,677	5.80	7.22	50.93	113.12
122	486	19	79	98	692	1,536	7.27	9.02	63.68	141.34
123	486	17	91	113	798	1,772	8.37	10.39	73.39	162.96
124	280	20	50	62	438	972	2.65	3.29	23.21	51.51
125	280	18	69	86	607	1,348	3.66	4.56	32.17	71.44
126	631	18	123	152	1,073	2,383	14.70	18.17	128.25	284.83
127	652	20	82	102	720	1,599	10.13	12.60	88.92	197.49
128	257	32	22	27	191	423	1.07	1.31	9.29	20.58
129	257	23	29	36	254	564	1.41	1.75	12.36	27.44
130	422	5	0	0	0	0	0.00	0.00	0.00	0.00
131	493	30	5	6	42	94	0.47	0.56	3.92	8.77
132	361	21	141	175	1,236	2,743	9.64	11.96	84.48	187.49
133	236	24	74	92	650	1,442	3.31	4.11	29.04	64.43
134	1,521	27	196	243	1,716	3,810	56.45	69.98	494.18	1,097.22
135	1,542	24	69	86	607	1,348	20.16	25.12	177.31	393.76
136	384	5	15	19	134	298	1.09	1.38	9.75	21.68
137	354	16	10	12	85	188	0.67	0.80	5.70	12.61

Table G-7 2014 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

			VOLUME				VMT			
Link Name	Link Distance (ft)	Link Speed (mph)	AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
139	96	15	40	49	346	768	0.73	0.89	6.31	14.00
140	295	24	69	86	607	1,348	3.85	4.80	33.90	75.29
142	257	17	157	195	1,377	3,057	7.63	9.48	66.93	148.58
144	518	9	170	211	1,490	3,308	16.66	20.68	146.05	324.25
145	195	18	47	58	410	909	1.74	2.15	15.17	33.63
146	463	18	44	54	381	847	3.86	4.73	33.39	74.24
147	230	18	211	261	1,843	4,092	9.20	11.38	80.38	178.46
148	794	18	40	49	346	768	6.01	7.36	52.01	115.43
149	661	18	84	104	734	1,630	10.52	13.02	91.88	204.05
150	281	18	84	104	734	1,630	4.47	5.54	39.07	86.76
151	360	18	39	48	339	752	2.66	3.27	23.10	51.23
152	88	32	3	4	28	63	0.05	0.07	0.47	1.06
153	66	30	46	57	402	894	0.57	0.71	5.02	11.16
154	173	32	49	61	431	956	1.61	2.00	14.13	31.35
155	258	30	221	274	1,935	4,296	10.82	13.41	94.72	210.29
156	645	26	122	151	1,066	2,367	14.89	18.43	130.13	288.95
157	218	22	100	124	876	1,944	4.13	5.12	36.15	80.22
158	185	23	242	300	2,118	4,703	8.49	10.52	74.30	164.98
159	354	19	342	424	2,994	6,647	22.94	28.44	200.86	445.93
160	470	28	46	57	402	894	4.09	5.07	35.75	79.50
161	94	15	167	207	1,462	3,245	2.98	3.70	26.13	57.99
162	50	15	0	0	0	0	0.00	0.00	0.00	0.00
163	66	15	167	207	1,462	3,245	2.10	2.60	18.39	40.82
164	367	33	52	65	459	1,019	3.62	4.52	31.92	70.87
165	124	27	75	93	657	1,458	1.76	2.18	15.39	34.15
166	84	27	59	73	515	1,144	0.94	1.17	8.23	18.29
167	956	27	59	73	515	1,144	10.68	13.22	93.25	207.13
168	380	15	43	53	374	831	3.09	3.81	26.90	59.76
169	293	14	102	126	890	1,975	5.67	7.00	49.44	109.71
170	205	33	16	20	141	314	0.62	0.78	5.47	12.17
171	158	5	0	0	0	0	0.00	0.00	0.00	0.00
172	180	5	0	0	0	0	0.00	0.00	0.00	0.00
173	48	5	0	0	0	0	0.00	0.00	0.00	0.00
174	502	14	201	249	1,758	3,904	19.10	23.66	167.04	370.94
175	640	12	334	414	2,923	6,490	40.49	50.18	354.31	786.69
176	319	23	997	1,236	8,727	19,377	60.15	74.57	526.52	1,169.06
177	286	26	997	1,236	8,727	19,377	54.02	66.97	472.86	1,049.92
178	353	23	797	988	6,976	15,489	53.35	66.14	466.98	1,036.86
179	348	32	788	977	6,898	15,316	51.89	64.33	454.20	1,008.49
180	366	30	635	787	5,557	12,338	44.02	54.55	385.19	855.21
181	453	14	77	96	678	1,505	6.60	8.23	58.16	129.09
182	119	14	77	96	678	1,505	1.73	2.15	15.22	33.78
183	50	14	65	80	565	1,254	0.62	0.76	5.35	11.87
184	54	14	49	61	431	956	0.50	0.62	4.37	9.70
185	62	14	52	64	452	1,003	0.61	0.75	5.29	11.74
186	39	14	119	147	1,038	2,305	0.88	1.09	7.71	17.12
187	208	5	0	0	0	0	0.00	0.00	0.00	0.00
188	212	5	0	0	0	0	0.00	0.00	0.00	0.00
189	218	5	0	0	0	0	0.00	0.00	0.00	0.00
190	193	32	13	16	113	251	0.47	0.58	4.13	9.17
191	169	5	0	0	0	0	0.00	0.00	0.00	0.00
192	540	5	68	84	593	1,317	6.96	8.60	60.69	134.80
193	138	12	328	406	2,867	6,365	8.56	10.60	74.83	166.13
194	932	16	321	398	2,810	6,239	56.64	70.23	495.84	1,100.92

Table G-7 2014 Existing Conditions - Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

			VOLUME				VMT			
Link Name	Link Distance (ft)	Link Speed (mph)	AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
195	79	14	15	19	134	298	0.23	0.29	2.01	4.48
196	49	14	213	264	1,864	4,139	1.96	2.43	17.18	38.14
197	83	14	213	264	1,864	4,139	3.37	4.17	29.48	65.45
198	692	14	262	325	2,295	5,095	34.34	42.60	300.80	667.78
199	70	28	248	307	2,168	4,813	3.30	4.09	28.86	64.06
200	158	5	0	0	0	0	0.00	0.00	0.00	0.00
201	160	9	47	58	410	909	1.42	1.75	12.40	27.49
202	335	22	47	58	410	909	2.98	3.68	26.00	57.65
203	30	5	0	0	0	0	0.00	0.00	0.00	0.00
204	2,022	8	116	144	1,017	2,257	44.42	55.14	389.41	864.22
205	71	25	332	411	2,902	6,443	4.48	5.55	39.20	87.02
206	142	25	242	300	2,118	4,703	6.52	8.08	57.07	126.73
207	859	32	234	290	2,048	4,546	38.06	47.16	333.08	739.34
208	284	33	190	236	1,666	3,700	10.22	12.69	89.61	199.01
209	80	30	528	654	4,618	10,253	8.04	9.95	70.29	156.06
210	71	30	634	786	5,550	12,322	8.57	10.63	75.05	166.62
211	390	30	719	891	6,291	13,968	53.09	65.78	464.48	1,031.29
212	117	30	326	404	2,853	6,334	7.24	8.97	63.35	140.64
213	1,344	26	1,114	1,381	9,751	21,650	283.66	351.65	2,482.92	5,512.79
214	449	31	1,024	1,269	8,960	19,894	87.03	107.86	761.54	1,690.85
215	1,110	31	99	123	868	1,928	20.80	25.85	182.41	405.16
216	905	31	432	535	3,777	8,387	74.08	91.75	647.71	1,438.26
217	1,050	31	251	311	2,196	4,876	49.91	61.84	436.67	969.58
218	581	28	620	768	5,423	12,040	68.19	84.47	596.45	1,324.22
219	1,063	32	342	424	2,994	6,647	68.88	85.39	603.00	1,338.73
220	415	32	342	424	2,994	6,647	26.87	33.32	235.26	522.31
221	698	5	0	0	0	0	0.00	0.00	0.00	0.00
222	1,920	22	17	21	148	329	6.18	7.64	53.83	119.66
223	1,564	29	962	1,192	8,416	18,687	284.93	353.05	2,492.66	5,534.73
224	377	28	316	392	2,768	6,145	22.59	28.02	197.84	439.20
225	551	28	84	104	734	1,630	8.77	10.85	76.59	170.08
226	788	32	85	105	741	1,646	12.69	15.67	110.59	245.65
227	1,303	32	254	315	2,224	4,938	62.66	77.71	548.67	1,218.22
228	580	29	940	1,165	8,226	18,264	103.31	128.04	904.10	2,007.35
229	1,653	30	343	425	3,001	6,663	107.37	133.04	939.44	2,085.80
230	2,058	28	597	740	5,225	11,601	232.70	288.44	2,036.60	4,521.84
231	1,300	22	578	716	5,055	11,225	142.27	176.24	1,244.24	2,762.93
232	736	24	596	739	5,218	11,585	83.05	102.98	727.10	1,614.31
233	488	28	612	759	5,359	11,899	56.57	70.15	495.33	1,099.82
234	449	11	420	521	3,679	8,168	35.71	44.30	312.80	694.47
235	310	9	333	413	2,916	6,475	19.55	24.24	171.18	380.10
236	310	5	87	108	763	1,693	5.12	6.35	44.87	99.56
237	105	5	184	228	1,610	3,574	3.67	4.54	32.09	71.23
238	697	31	100	124	876	1,944	13.19	16.36	115.57	256.46
239	186	26	73	91	643	1,427	2.57	3.20	22.60	50.16
240	145	28	123	152	1,073	2,383	3.39	4.18	29.54	65.60
241	578	28	196	243	1,716	3,810	21.47	26.62	188.00	417.42
242	125	32	100	124	876	1,944	2.36	2.93	20.71	45.96
243	564	32	99	123	868	1,928	10.57	13.14	92.70	205.90
244	88	32	100	124	876	1,944	1.66	2.06	14.52	32.22
245	48	5	0	0	0	0	0.00	0.00	0.00	0.00
246	175	14	194	241	1,702	3,778	6.43	7.99	56.40	125.20
247	65	22	3	4	28	63	0.04	0.05	0.35	0.78

Table G-7 2014 Existing Conditions - Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

			VOLUME				VMT			
Link Name	Link Distance (ft)	Link Speed (mph)	AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
248	39	14	297	368	2,598	5,769	2.18	2.70	19.08	42.36
249	128	14	198	245	1,730	3,841	4.79	5.93	41.87	92.95
250	484	14	206	255	1,800	3,998	18.90	23.40	165.16	366.84
251	388	5	0	0	0	0	0.00	0.00	0.00	0.00
252	308	16	307	380	2,683	5,957	17.94	22.20	156.75	348.02
253	54	13	10	12	85	188	0.10	0.12	0.87	1.92
254	51	5	0	0	0	0	0.00	0.00	0.00	0.00
255	290	31	3	4	28	63	0.17	0.22	1.54	3.47
256	377	31	44	55	388	862	3.14	3.93	27.72	61.58
257	215	31	27	33	233	517	1.10	1.34	9.49	21.07
258	321	28	0	0	0	0	0.00	0.00	0.00	0.00
259	203	28	0	0	0	0	0.00	0.00	0.00	0.00
260	362	28	2	3	21	47	0.14	0.21	1.44	3.22
261	219	31	21	26	184	408	0.87	1.08	7.64	16.95
262	218	13	6	7	49	110	0.25	0.29	2.02	4.53
263	177	33	23	29	205	455	0.77	0.97	6.86	15.23
264	157	5	0	0	0	0	0.00	0.00	0.00	0.00
265	2,458	26	104	129	911	2,022	48.41	60.05	424.08	941.25
266	752	26	136	169	1,193	2,649	19.37	24.07	169.90	377.26
267	1,323	26	204	253	1,786	3,966	51.10	63.38	447.39	993.47
268	1,252	30	419	519	3,665	8,136	99.32	123.03	868.77	1,928.59
269	302	30	19	23	162	361	1.09	1.32	9.28	20.68
270	1,005	16	644	798	5,634	12,510	122.57	151.89	1,072.33	2,381.06
271	954	14	530	657	4,639	10,300	95.74	118.68	837.95	1,860.51
272	656	18	532	659	4,653	10,331	66.10	81.88	578.17	1,283.69
273	485	6	536	664	4,688	10,410	49.24	61.00	430.70	956.40
274	1,244	26	149	185	1,306	2,900	35.11	43.59	307.70	683.26
275	419	5	0	0	0	0	0.00	0.00	0.00	0.00
276	649	26	136	169	1,193	2,649	16.71	20.77	146.59	325.50
277	2,473	24	102	126	890	1,975	47.78	59.02	416.92	925.19
278	573	31	256	317	2,238	4,970	27.79	34.41	242.95	539.53
279	458	18	290	360	2,542	5,644	25.14	31.21	220.38	489.31
280	295	25	220	273	1,928	4,280	12.30	15.26	107.79	239.28
281	440	14	212	263	1,857	4,123	17.65	21.90	154.60	343.25
282	76	14	141	175	1,236	2,743	2.04	2.53	17.89	39.71
283	697	14	303	376	2,655	5,895	39.97	49.60	350.24	777.65
284	690	19	503	624	4,406	9,782	65.69	81.49	575.41	1,277.51
285	91	19	489	606	4,279	9,500	8.42	10.44	73.71	163.65
286	464	19	822	1,019	7,195	15,975	72.25	89.56	632.40	1,404.11
287	229	26	789	978	6,905	15,332	34.25	42.45	299.70	665.47
288	500	10	787	975	6,884	15,285	74.46	92.24	651.27	1,446.07
289	738	22	1,530	1,897	13,394	29,739	213.87	265.17	1,872.23	4,156.96
290	190	26	1,359	1,685	11,897	26,416	48.84	60.55	427.55	949.32
291	494	32	394	488	3,446	7,650	36.88	45.68	322.58	716.12
292	689	21	967	1,198	8,459	18,781	126.11	156.23	1,103.16	2,449.27
293	325	27	1,384	1,716	12,116	26,902	85.21	105.65	745.93	1,656.25
294	396	19	261	324	2,288	5,079	19.59	24.32	171.74	381.25
295	1,017	29	1,125	1,395	9,850	21,869	216.72	268.73	1,897.51	4,212.86
296	162	16	170	211	1,490	3,308	5.22	6.48	45.76	101.59
297	140	16	170	211	1,490	3,308	4.50	5.59	39.47	87.63
298	951	7	200	248	1,751	3,888	36.03	44.68	315.49	700.52
299	805	17	126	156	1,101	2,446	19.21	23.79	167.88	372.96

Table G-7 2014 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

Link Name	Link Distance (ft)	Link Speed (mph)	VOLUME AM Peak	VOLUME PM Peak	VOLUME High 8-Hour	VOLUME AWDT	VMT AM Peak	VMT PM Peak	VMT High 8-Hour	VMT AWDT
299	805	17	126	156	1,101	2,446	19.21	23.79	167.88	372.96
300	518	15	70	87	614	1,364	6.87	8.54	60.27	133.88
301	749	6	103	128	904	2,007	14.61	18.16	128.27	284.77
302	652	8	262	325	2,295	5,095	32.35	40.13	283.39	629.14
303	547	5	58	72	508	1,129	6.00	7.45	52.59	116.88
304	406	10	34	42	297	658	2.61	3.23	22.83	50.58
305	442	5	19	23	162	361	1.59	1.93	13.57	30.23
306	207	5	52	65	459	1,019	2.04	2.55	18.00	39.97
307	70	5	111	137	967	2,148	1.47	1.82	12.82	28.48
308	319	9	61	75	530	1,176	3.69	4.53	32.03	71.07
309	281	6	86	107	755	1,677	4.58	5.69	40.16	89.21
310	555	29	387	480	3,389	7,525	40.65	50.41	355.94	790.34
311	208	27	387	480	3,389	7,525	15.25	18.91	133.51	296.44
312	125	27	938	1,163	8,212	18,232	22.21	27.53	194.41	431.63
313	332	24	704	872	6,157	13,670	44.31	54.88	387.51	860.37
314	440	24	1,139	1,412	9,970	22,136	94.96	117.72	831.21	1,845.50
315	215	19	691	856	6,044	13,420	28.14	34.86	246.15	546.56
316	543	13	119	148	1,045	2,320	12.24	15.23	107.51	238.68
317	180	8	207	257	1,815	4,029	7.06	8.76	61.88	137.36
318	221	9	207	257	1,815	4,029	8.65	10.74	75.87	168.43
319	2,544	10	306	379	2,676	5,942	147.43	182.60	1,289.26	2,862.78
320	552	11	377	467	3,297	7,321	39.39	48.79	344.49	764.93
321	628	10	98	121	854	1,897	11.66	14.40	101.63	225.74
322	181	7	372	461	3,255	7,227	12.75	15.81	111.60	247.79
323	58	9	324	402	2,838	6,302	3.58	4.44	31.33	69.57
324	387	12	21	26	184	408	1.54	1.91	13.50	29.93
325	406	9	344	427	3,015	6,694	26.43	32.81	231.65	514.32
326	89	5	73	90	635	1,411	1.23	1.51	10.67	23.70
327	463	10	351	435	3,071	6,820	30.78	38.15	269.31	598.07
328	79	19	407	505	3,566	7,917	6.09	7.56	53.40	118.55
329	103	19	407	505	3,566	7,917	7.91	9.81	69.30	153.85
330	323	12	26	32	226	502	1.59	1.96	13.82	30.69
331	179	10	283	351	2,478	5,503	9.59	11.90	83.98	186.49
332	993	8	465	576	4,067	9,030	87.43	108.31	764.72	1,697.91
333	384	13	15	18	127	282	1.09	1.31	9.24	20.52
334	366	20	415	514	3,629	8,058	28.74	35.60	251.32	558.05
335	583	27	674	835	5,896	13,090	74.42	92.19	650.99	1,445.30
336	428	27	727	901	6,362	14,125	58.97	73.08	516.02	1,145.68
337	94	24	211	261	1,843	4,092	3.77	4.66	32.89	73.03
338	366	5	156	193	1,363	3,026	10.81	13.37	94.43	209.64
339	311	5	55	68	480	1,066	3.23	4.00	28.23	62.70
340	273	18	20	25	177	392	1.03	1.29	9.14	20.25
341	66	15	20	25	177	392	0.25	0.31	2.21	4.88
342	48	5	0	0	0	0	0.00	0.00	0.00	0.00
343	52	22	47	58	410	909	0.46	0.57	4.04	8.95
344	82	12	35	43	304	674	0.54	0.67	4.73	10.48
345	25	5	73	90	635	1,411	0.35	0.43	3.01	6.68
346	121	5	73	91	643	1,427	1.67	2.08	14.68	32.59
347	303	9	108	134	946	2,101	6.20	7.69	54.27	120.53
348	146	9	465	576	4,067	9,030	12.87	15.94	112.58	249.96
349	67	9	194	241	1,702	3,778	2.45	3.05	21.52	47.76

Table G-7 2014 Existing Conditions – Airport-Related Traffic, On-Airport Link Attributes, Traffic Assignment and Vehicle Miles Traveled (VMT) Summary (Continued)

			VOLUME				VMT			
Link Name	Link Distance (ft)	Link Speed (mph)	AM Peak	PM Peak	High 8-Hour	AWDT	AM Peak	PM Peak	High 8-Hour	AWDT
350	446	5	194	240	1,695	3,762	16.38	20.26	143.09	317.59
351	335	5	32	40	282	627	2.03	2.54	17.92	39.84
352	430	5	226	280	1,977	4,390	18.39	22.78	160.87	357.22
353	360	5	47	58	410	909	3.20	3.95	27.92	61.89
354	50	14	109	135	953	2,116	1.03	1.28	9.02	20.04
355	88	5	191	237	1,673	3,715	3.19	3.96	27.94	62.04
356	113	5	459	569	4,018	8,920	9.83	12.18	86.02	190.96
358	463	5	0	0	0	0	0.00	0.00	0.00	0.00
359	229	13	4	5	35	78	0.17	0.22	1.52	3.39
360	245	14	4	5	35	78	0.19	0.23	1.63	3.63
361	248	17	35	43	304	674	1.64	2.02	14.27	31.63
362	199	9	32	40	282	627	1.21	1.51	10.64	23.65
363	230	22	39	48	339	752	1.70	2.09	14.75	32.73
364	256	19	36	45	318	705	1.75	2.18	15.43	34.20
365	201	23	15	19	134	298	0.57	0.72	5.10	11.33
366	201	11	71	88	621	1,380	2.71	3.35	23.66	52.59
367	337	31	682	845	5,966	13,247	43.54	53.94	380.85	845.66
368	868	11	476	590	4,166	9,249	78.29	97.04	685.20	1,521.22
369	167	9	439	544	3,841	8,528	13.92	17.24	121.76	270.34
370	96	10	273	338	2,387	5,299	4.95	6.12	43.25	96.00
371	141	26	571	708	4,999	11,099	15.24	18.90	133.42	296.22
372	283	17	248	307	2,168	4,813	13.29	16.45	116.14	257.83
373	283	24	109	135	953	2,116	5.84	7.23	51.05	113.35
				Logan Airport VMT			8,155	10,107	71,361	158,443

AWDT = Average annual weekday daily traffic

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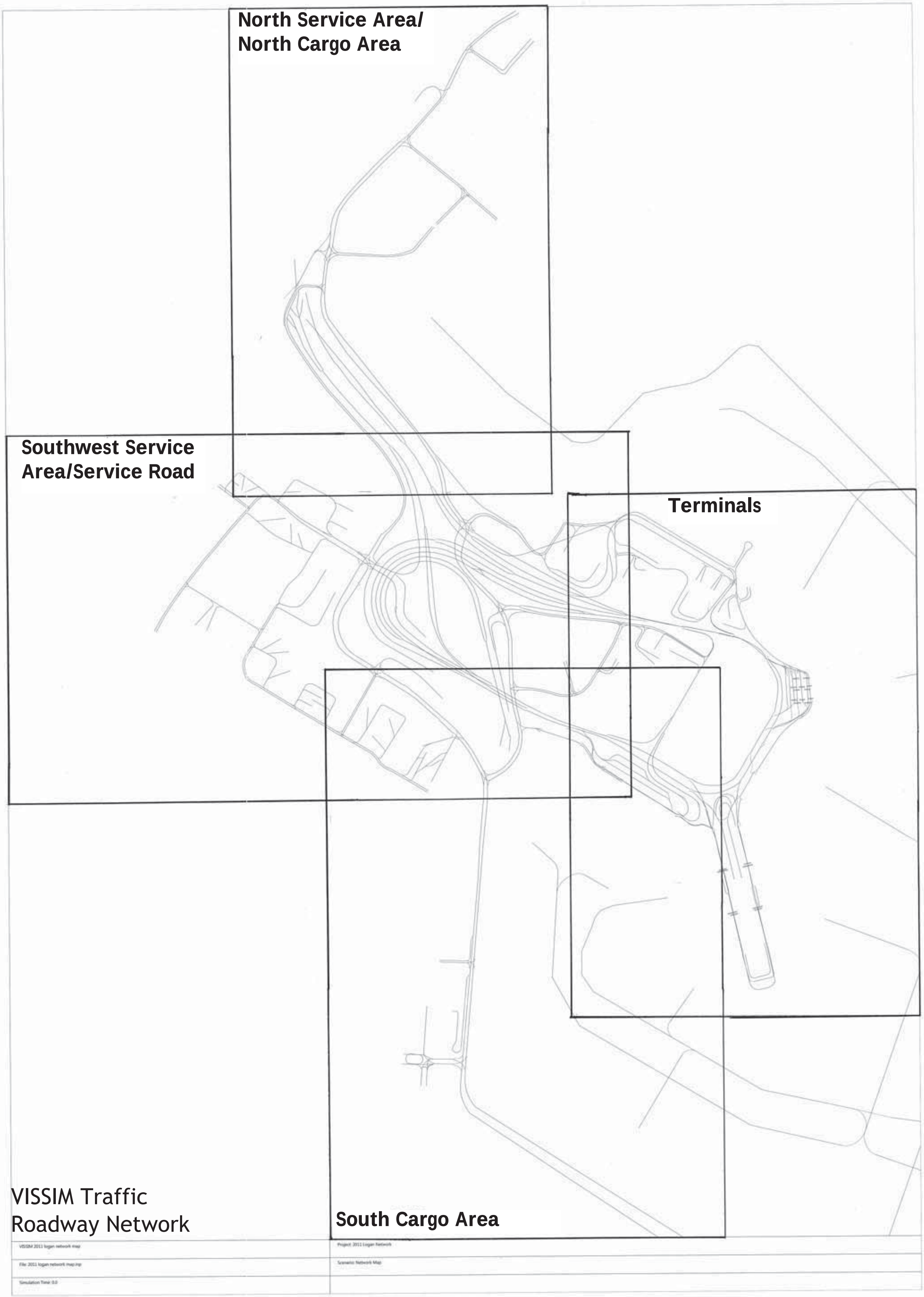
North Service Area/
North Cargo Area
Southwest Service
Area/Service Road
Terminals
South Cargo Area
VISSIM Traffic
Roadway Network


PRESCOTT
FRANKFORT
LOVELL
ECONOMY DRIVEWAY
North Service Area/
North Cargo Area
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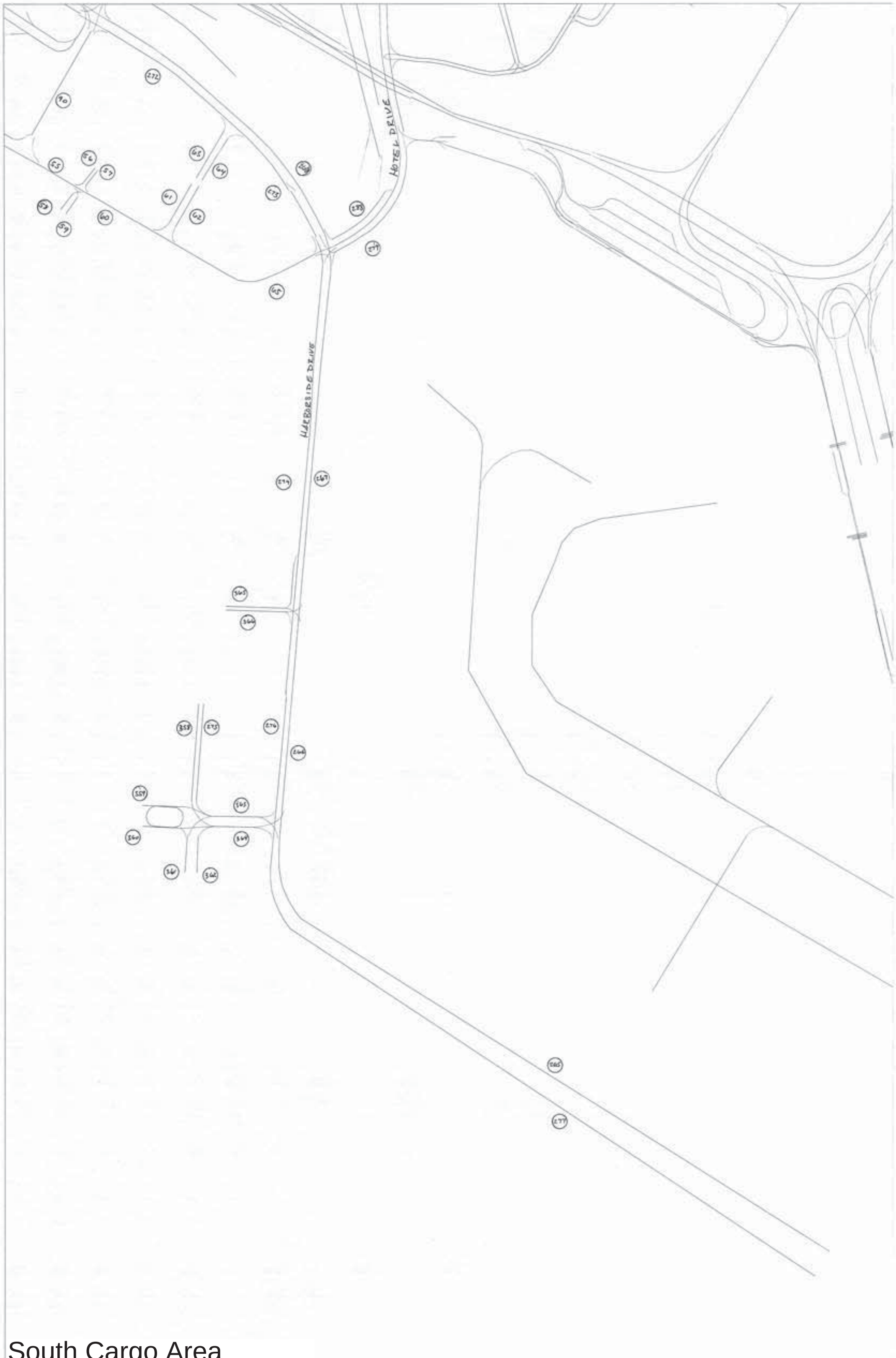
Project: 11122.05 Logan ESPR Link Map
NCA / NS1
Scenario: 2030 Model



South Cargo Area

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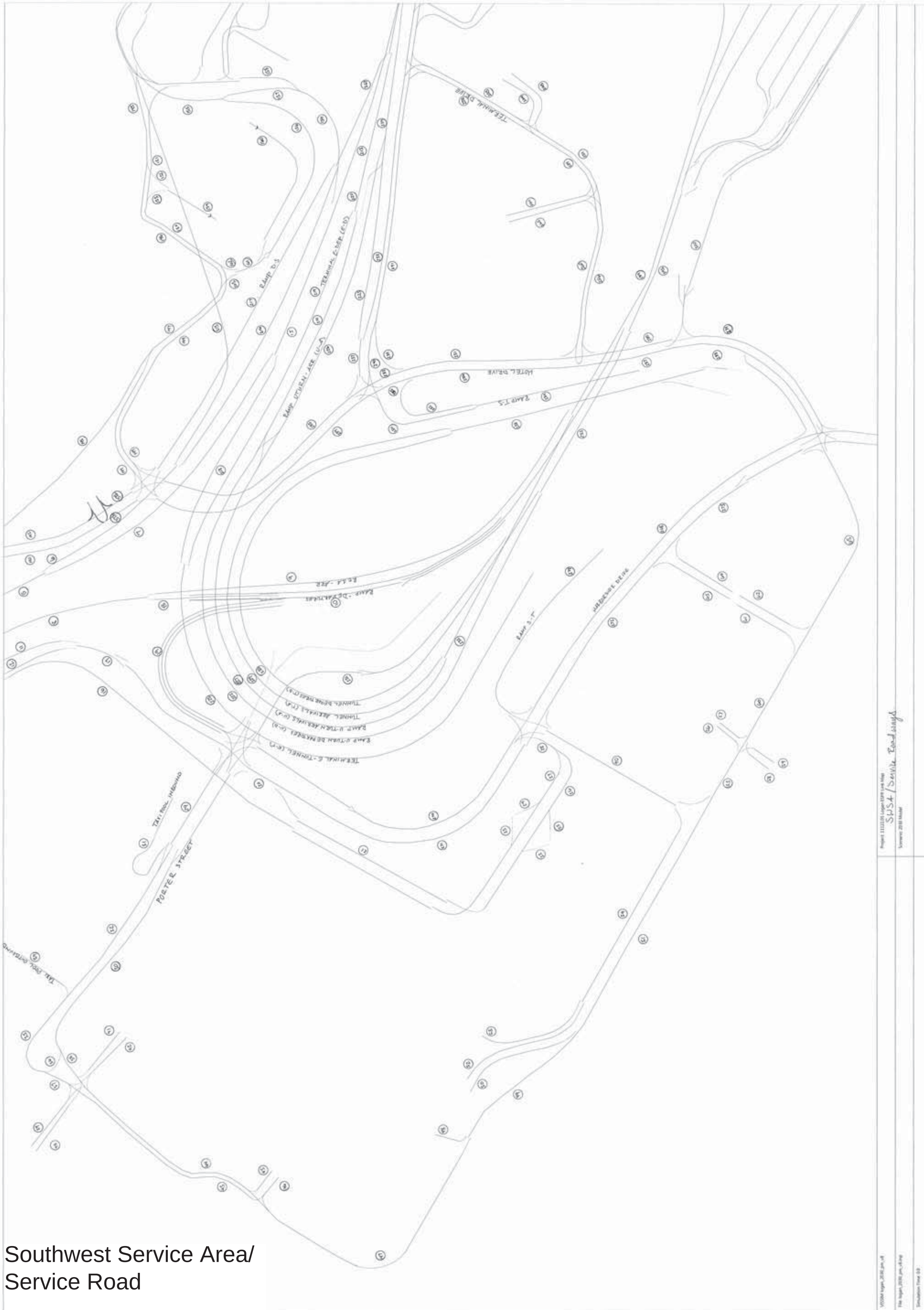
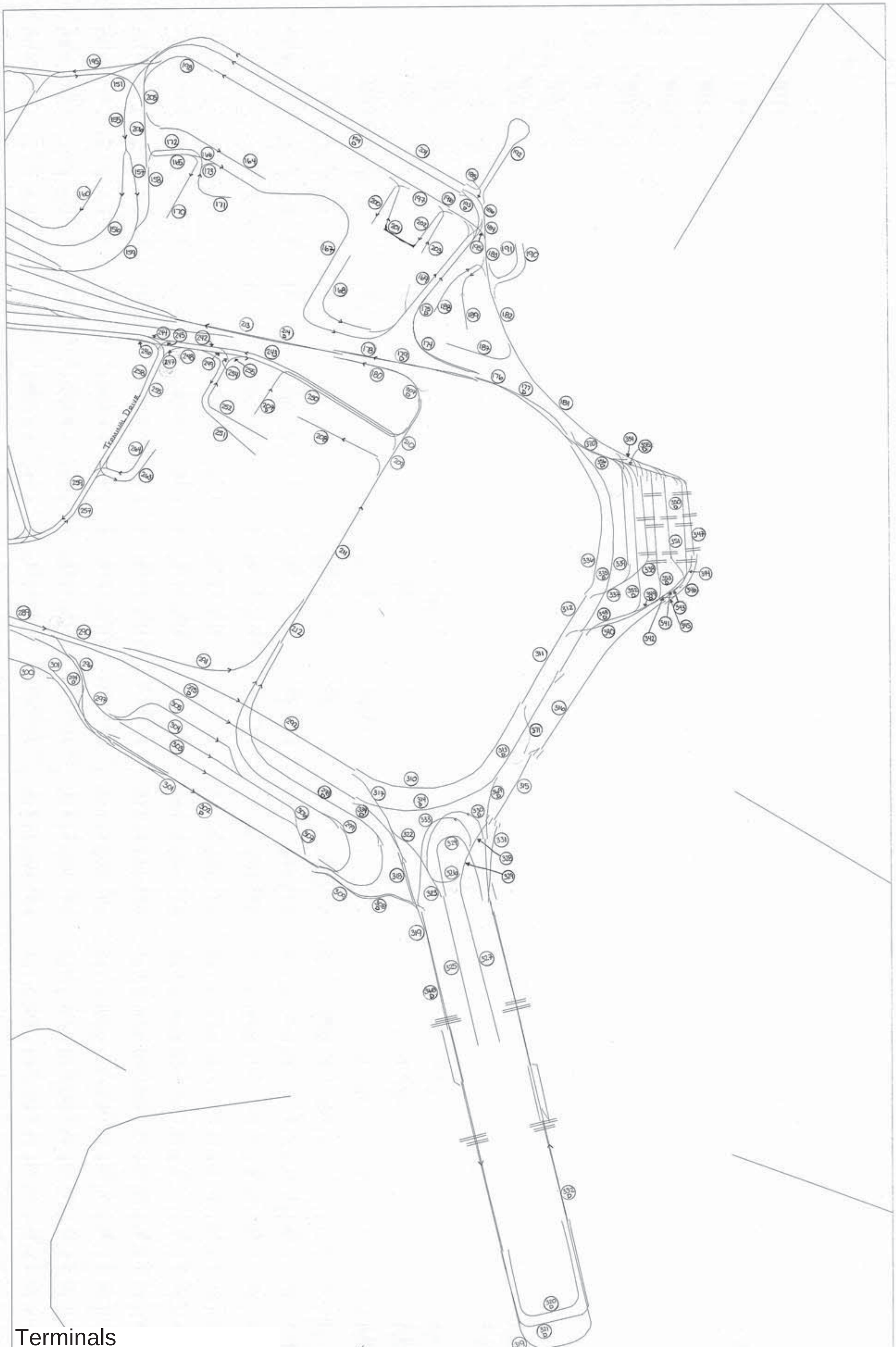
File: logan_2030_pm_v8.inp	Scenario: 2030 Model
Simulation Time: 0.0	



Southwest Service Area/
Service Road



Terminals

VISSIM logan printable version
File: logan printable version.inp
Simulation Time: 0.0

Project: Logan Airport Link Map - 2030 - Terminals
Scenario: Logan Tunnel Ramps, Rental Car Lots

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massport
Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

February 28th, 2014

Christine Kirby, Deputy Director
Department of Environmental Protection
Division of Consumer and Transportation Programs
Bureau of Waste Prevention
One Winter Street
Boston, MA 02108

Re: March 1st, 2014 Logan Airport Parking Space Inventory

Dear Ms. Kirby:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following March 1st, 2014 Massachusetts Port Authority submissions:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

Massport's parking program remains in compliance with the Aviation and Transportation Security Act of 2001 (ATSA) and supplemental FAA security directives, and our top priority continues to be the safe and secure operation of our transportation and parking facilities. We continue to provide information on rental car spaces as a courtesy.

The attachments provide the quantity, physical distribution and allocation of commercial and employee parking spaces as defined by 310 CMR 7.30, as amended. These inventory tables are based on information provided by the Aviation Department; the employee and commercial space counts are supported by comprehensive field checks and counts recently conducted in February 2014.

The Commercial Parking Space Inventory totals 18,415 spaces; the Employee Parking Space Inventory totals 2,673 employee parking spaces; the total inventory of spaces at Logan Airport is 21,088. This revised total reflects the additional 150 spaces transferred from Paul's Parking as confirmed in your June 4th, 2013 letter to Massport and the Boston Air Pollution Control Commission.

The new Rental Car Center opened in September of 2013; consequently, most rental car operations have been transferred to the new facility. This March 1st, 2014 submission includes a revised location map showing the footprint of the new facility; the map reference is R1. However, portions of the South West Service Area remain under construction as part of completing the Rental Car Center project; this activity may continue to affect the location of some rental car spaces.

As you may know, demand for commercial parking at Logan Airport continues to be strong. While the Aviation Department deploys operational innovations to accommodate passenger parking demand, a broader strategic planning effort is underway to plan for ground access needs at future passenger levels. As part of this effort, Massport is proposing to consolidate all remaining (i.e., designated) parking spaces allowed under the freeze by making structural additions to existing parking facilities located in the central terminal area. That proposal is the subject of a Request for Advisory Opinion (RAO) filed with the MEPA office on February 18th, 2014; the allocation of commercial parking spaces presented in Table 1 of that RAO is identical to those in the attached inventory.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at (617) 568-3570.

Sincerely,

Craig Leiner

Craig Leiner
Economic Planning & Development Department

cc: L. Dantas
S. Dalzell
I. Wallach
B. Desrosiers
D. Conroy

Commercial Parking Space Inventory
Logan International Airport
March 1, 2014 Submission

Commercial Parking Spaces

Map ID#	Location of Commercial Parking Areas	Number of Spaces
Terminal Area and Economy Spaces		
C1	Central Garage	7,077
C2	West Garage	3,190
C3	Terminal B Garage	2,254
C5	Terminal E Lot 1	275
C6	Terminal E Lot 2	248
C7	Terminal E Lot 3 (fka "Gulf Station" Lot)	219
C8	Economy Garage	2,809
	subtotal	*16,072*
Hotel Spaces		
C4a & C4b	Logan Airport Hilton Hotel (two lots)	235
C10	Harborside Hyatt Conference Center	270
	subtotal	*505*
General Aviation Spaces		
C9	Signature (General Aviation Terminal)	35
	subtotal	*35*

Total In-Service Commercial Parking Spaces	**16,612**
Total Designated Commercial Parking Spaces	**1,803**
Total Commercial Parking Spaces	**18,415**
Total Employee Parking Spaces *(see table on next page)*	**2,673**
TOTAL PARKING FREEZE SPACES	**21,088**

Employee Parking Space Inventory
Logan International Airport
March 1, 2014 Submission

Employee Parking Spaces

Area	Map ID#	Location of Employee Parking Areas	Number of Spaces
Terminal Area	E81	West Garage	98
	E26	Airport Tower/Administration (parking in Central Garage)	513
	E20 a&b	Terminal C Pier A (Old Terminal D) (two lots)	122
	E18	Massport Facilities 1 (Heating Plant)	92
	E34	Hilton Hotel employee lot	28
	E86	Gulf Gas Station	4
North Service Area	E68a	LSG Sky Chefs (Bldg. 68), main lot	25
	E68b	LSG Sky Chefs (Bldg. 68), overflow lot	126
	E1	Flight Kitchen Building 1 (and nearby lot)	80
	E40	Lovell Street Lot (contractor trailer)	25
	E53	Green Bus Depot (Bus Maintenance Facility)	12
	E59	Temporary Limo Lot	2
	E11a	North Cargo Building 11, TSA lot	93
	E11b	North Cargo Building 11, State Police lot	136
	E43	North Gate & EMS Trailer (EMS Station A7)	26
	E8	North Cargo Building 8	114
	E5	US Airways Administration/Hangar (Bldg. 5)	75
	N/A	Massport Facilities 2 (airside, Bldg. 3)	0
	E4	Massport Facilities 3 (landside, Bldg. 4)	69
	E13	UPS (Cargo Building 13)	44
	E94	United Aircraft Maintenance (Buildings 93 & 94)	56
SW	E60	Rental Car Center (Customer Service Center)	4
South Service Area	E84	Bird Island Flats / Logan Office Center (LOC) Garage	425
	E72	Taxi Pool	7
	E63	South Cargo Building 63	16
	E62	South Cargo Building 62	43
	E58	South Cargo Building 58	23
	E57	South Cargo Building 57	44
	E56	South Cargo Building 56	39
	E78	Fire-Rescue HQ & Amelia Earhart Terminal/Hangar	84
	N/A	*ARFF Satellite Station* [1]	0

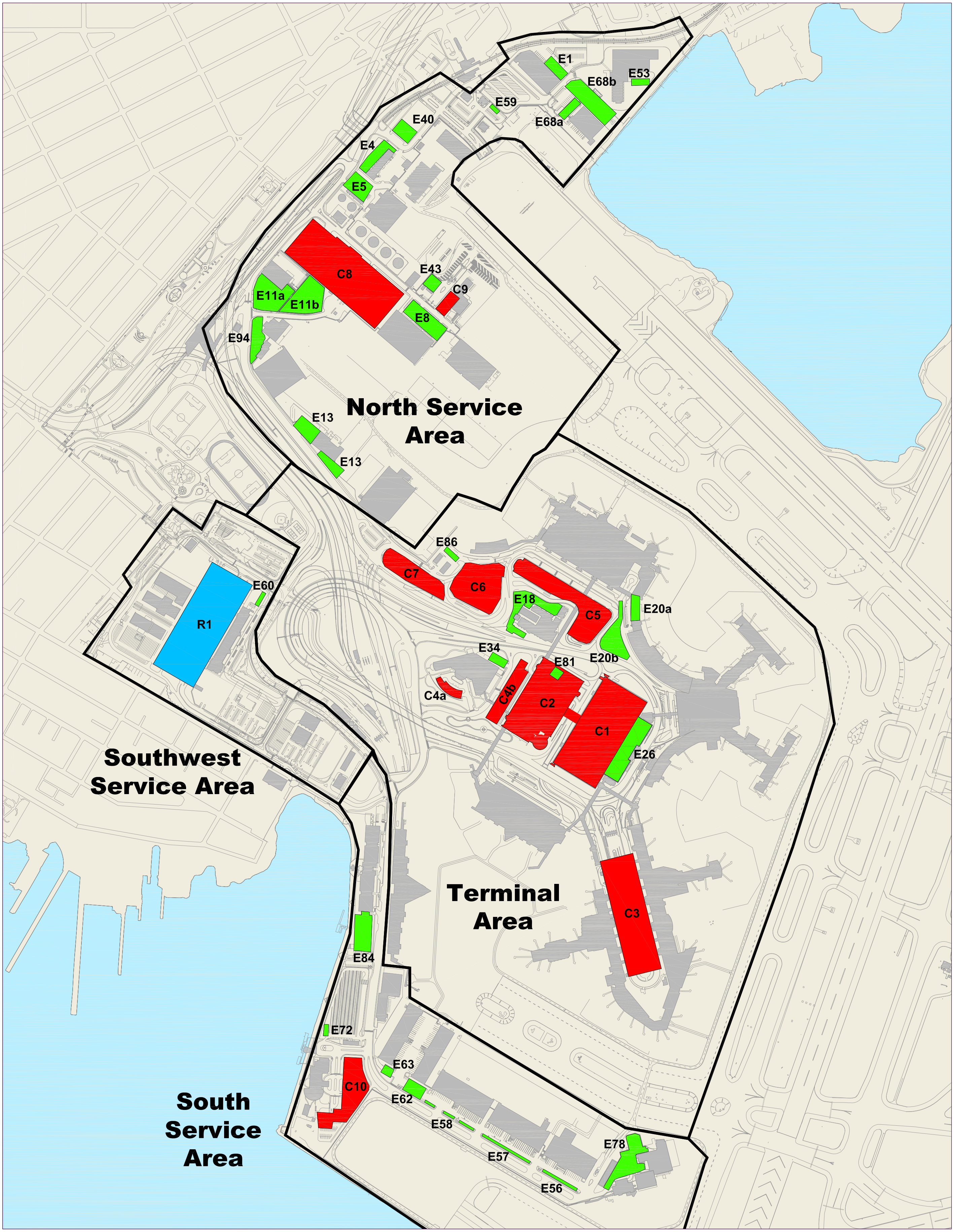
[1] This facility is located on the airfield and is not shown in the map. No employee parking spaces are provided.

Total In-Service Employee Parking Spaces	**2,425**
Total Designated Employee Parking Spaces	**248**
Total Employee Parking Spaces	**2,673**
Total Commercial Parking Spaces *(see table on previous page)*	**18,415**
TOTAL PARKING FREEZE SPACES	**21,088**

For Information Only:
Rental Car Spaces Inventory
Logan International Airport
March 1, 2014 Submission

Rental Car Company Parking Spaces

Map ID#		Number of Spaces
R1	Rental Car Center (RCC)	5,020
Total Rental Car Spaces		**5,020**



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Logan Airport
Parking Space Inventory

Logan International Airport
East Boston, MA
Massachusetts Port Authority
March 1, 2014

Legend:

- Logan Parking Service Area Zones
- Commercial Parking Space Locations
- Employee Parking Space Locations
- Rental Car Parking Space Locations

N

0 250 500 1000
in feet

Notes:

This plan is intended for informational purposes only and no use may be made of the same without the express written permission of the Massachusetts Port Authority ("Massport"). Massport does not certify the accuracy, information or title to the properties contained in this plan nor make any warranties of any kind, express or implied, in fact or by law, with respect to any boundaries, easements, restrictions, claims, overlaps or other encumbrances affecting such properties.

Massachusetts Port Authority
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www.massport.com

September 2, 2014

Christine Kirby, Deputy Director
Department of Environmental Protection
Division of Consumer and Transportation Programs
Bureau of Waste Prevention
One Winter Street
Boston, MA 02108

Re: September 1st, 2014, Logan Airport Parking Space Inventory

Dear Ms. Kirby:

In compliance with the reporting requirements of 310 CMR 7.30 (3)(d), enclosed are the following September 1st, 2014, Massachusetts Port Authority (Massport) submissions:

- Commercial Parking Space Inventory
- Employee Parking Space Inventory
- Location Map

The attachments provide the quantity, physical distribution, and allocation of commercial and employee parking spaces on the airport, as defined by 310 CMR 7.30, as amended. These inventory tables are based on information provided by the Aviation Department; the employee and commercial space counts are supported by comprehensive field checks and counts recently conducted in August 2014. We continue to provide information on rental car spaces as a courtesy.

Massport's parking program remains in compliance with the Aviation and Transportation Security Act of 2001 (ATSA) and supplemental FAA security directives, and our top priority continues to be the safe and secure operation of our transportation and parking facilities.

The Commercial Parking Space Inventory totals 18,415 spaces; the Employee Parking Space Inventory totals 2,673 parking spaces; the total inventory of spaces at Logan Airport is 21,088.

Demand for commercial parking at Logan Airport continues to be strong. While the Aviation Department deploys operational innovations to accommodate passenger parking demand, a broader strategic planning effort is underway to plan for ground access needs at future passenger levels. As part of this effort, Massport is planning to consolidate all remaining (i.e., designated) parking spaces allowed under the freeze by making structural additions to existing parking garages located in the central terminal area.

The attached Logan Airport Parking Space Inventory reflects Massport's successful management of its parking program, within the requirements of 310 CMR 7.30, as amended. If you have any questions, please call me at (617) 561-3425.

Sincerely,

Lourenço Dantas
Senior Transportation Planner
Planning Department

cc: C. Leiner, MPA
S. Dalzell, MPA
I. Wallach, MPA
B. Desrosiers, MPA
D. Conroy, EPA

Commercial Parking Space Inventory
Logan International Airport
September 1, 2014 Submission

Commercial Parking Spaces

Map ID#	Location of Commercial Parking Areas	Number of Spaces
Terminal Area and Economy Spaces		
C1	Central Garage	7,077
C2	West Garage	3,190
C3	Terminal B Garage	2,254
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C6	Terminal E Lot 2	248
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	subtotal	*16,072*
Hotel Spaces		
C4a & C4b	Logan Airport Hilton Hotel (two lots)	235
C10	Harborside Hyatt Conference Center	270
	subtotal	*505*
General Aviation Spaces		
C9	Signature (General Aviation Terminal)	35
	subtotal	*35*

Total In-Service Commercial Parking Spaces	**16,612**
Total Designated Commercial Parking Spaces	**1,803**
Total Commercial Parking Spaces	**18,415**
Total Employee Parking Spaces *(see table on next page)*	**2,673**
TOTAL PARKING FREEZE SPACES	**21,088**

Employee Parking Space Inventory
Logan International Airport
September 1, 2014 Submission

Employee Parking Spaces

	Map ID#	Location of Employee Parking Areas	Number of Spaces
Terminal Area	E81	West Garage	98
	E26	Airport Tower/Administration (parking in Central Garage)	524
	E20	Terminal C Pier A (Old Terminal D) (two lots)	122
	E18	Massport Facilities 1 (Heating Plant)	92
	E34	Hilton Hotel employee lot	28
	E86	Gulf Gas Station	4
North Service Area	E68a	LSG Sky Chefs (Bldg. 68), main lot	25
	E68b	LSG Sky Chefs (Bldg. 68), overflow lot	126
	E1	Flight Kitchen Building 1 (and nearby lot)	80
	E40	Lovell Street Lot (contractor trailer)	25
	E53	Green Bus Depot (Bus Maintenance Facility)	12
	E59	Temporary Limo Lot	2
	E11a	North Cargo Building 11, TSA lot	93
	E11b	North Cargo Building 11, State Police lot	136
	E43	North Gate & EMS Trailer (EMS Station A7)	26
	E8	North Cargo Building 8	114
	E5	US Airways Administration/Hangar (Bldg. 5)	75
	N/A	Massport Facilities 2 (airside, Bldg. 3)	0
	E4	Massport Facilities 3 (landside, Bldg. 4)	69
	E13	UPS (Cargo Building 13)	44
	E94	United Aircraft Maintenance (Buildings 93 & 94)	56
SW	E60	Rental Car Center (Customer Service Center)	4
South Service Area	E84	Bird Island Flats / Logan Office Center (LOC) Garage	425
	E72	Taxi Pool	7
	E63	South Cargo Building 63	16
	E62	South Cargo Building 62	43
	E58	South Cargo Building 58	23
	E57	South Cargo Building 57	44
	E56	South Cargo Building 56	39
	E78	Fire-Rescue HQ & Amelia Earhart Terminal/Hangar	84
	N/A	*ARFF Satellite Station* [1]	0

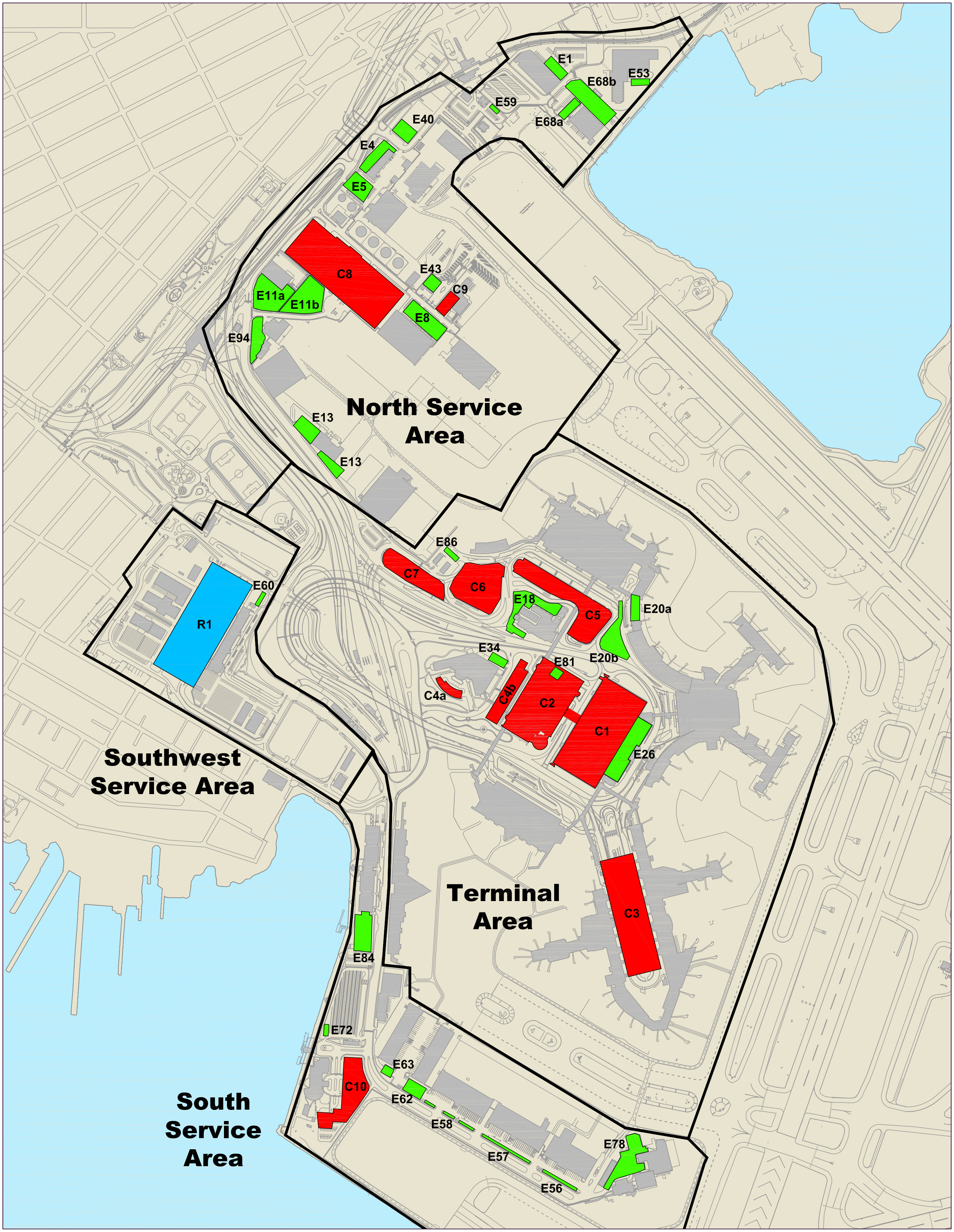
[1] This facility is located on the airfield and is not shown in the map. No employee parking spaces are provided.

Total In-Service Employee Parking Spaces	**2,436**
Total Designated Employee Parking Spaces	**237**
Total Employee Parking Spaces	**2,673**
Total Commercial Parking Spaces *(see table on previous page)*	**18,415**
TOTAL PARKING FREEZE SPACES	**21,088**

For Information Only:
Rental Car Spaces Inventory
Logan International Airport
September 1, 2014 Submission

Rental Car Company Parking Spaces

Map ID#		Number of Spaces
R1	Rental Car Center (RCC)	5,020
Total Rental Car Spaces		**5,020**



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Logan Airport
Parking Space Inventory

Logan International Airport
East Boston, MA

Massachusetts Port Authority
September 1, 2014

Legend:

- Logan Parking Service Area Zones
- Commercial Parking Space Locations
- Employee Parking Space Locations
- Rental Car Parking Space Locations

N
0 250 500 1000
in feet

Notes:

This plan is intended for informational purposes only and no use may be made of the same without the express written permission of the Massachusetts Port Authority ("Massport"). Massport does not certify the accuracy, information or title to the properties contained in this plan nor make any warranties of any kind, express or implied, in fact or by law, with respect to any boundaries, easements, restrictions, claims, overlaps or other encumbrances affecting such properties.

H

Noise Abatement

This appendix provides detailed information, tables, and figures in support of *Chapter 6, Noise Abatement*:

- Fundamentals of Acoustics and Environmental Noise
  - Figure H-1 Frequency-Response Characteristics of Various Weighting Networks
  - Figure H-2 Common Environmental Sound Levels, in dBA
  - Figure H-3 Variations in the A-Weighted Sound Level Over Time
  - Figure H-4 Sound Exposure Level (SEL)
  - Figure H-5 Example of a One Minute Equivalent Sound Level (L_{eq})
  - Figure H-6 Daily Noise Dose
  - Figure H-7 Examples of Day-Night Average Sound Levels (DNL)
  - Figure H-8 Outdoor Speech Intelligibility
  - Figure H-9 Probability of Awakening at Least Once from Indoor Noise Event
  - Figure H-10 Percentage of People Highly Annoyed
  - Figure H-11 Community Reaction as a Function of Outdoor DNL

- Regulatory Framework

- Logan Airport RealContoursTM Data Inputs
  - Figure H-12 Schematic Noise Modeling Process (Standard INM vs. RealContours™)
  - Table H-1a 2013 Annual Modeled Operations
  - Table H-1b 2014 Annual Modeled Operations
  - Table H-2a 2013 Modeled Runway Use by Aircraft Group
  - Table H-2b 2014 Modeled Runway Use by Aircraft Group
  - Table H-3a Summary of Jet and Non-Jet Aircraft Runway Use: 2013
  - Table H-3b Summary of Jet and Non-Jet Aircraft Runway Use: 2014
  - Table H-4 Total 2013 and 2014 Modeled Runway Use by All Operations
  - Table H-5 Total Count of Flight Tracks Modeled in RealContours™ (2013 and 2014)
  - Table H-6 Modeled Daily Operations by Commercial & GA Aircraft – 1990 to 2014
  - Table H-7 Percentage of Commercial Jet Operations by Part 36 Stage Category – 1999 to 2014
  - Table H-8 Modeled Nighttime Operations at Logan Airport – 1990 to 2014
  - Table H-9 Summary of Jet Aircraft Runway Use – 1990 to 2014

- Annual Model Results and Status of Mitigation Programs
  - Table H-10 Noise-Exposed Population by Community
  - Table H-11 Residential Sound Insulation Program (RSIP) Status (1986-2014)
  - Table H-12 Schools Treated Under Massport Sound Insulation Program
  - Figure H-13 Number of Callers and Complaints between 2000 and 2014

Fundamentals of Acoustics and Environmental Noise

Introduction

This section introduces the fundamentals of acoustics and noise terminology as well as the effects of noise on human activity and community annoyance.

Introduction to Acoustics and Noise Terminology

Chapter 6, Noise Abatement of this *2014 Environmental Data Report (EDR)* relies largely on a measure of cumulative noise exposure over an entire calendar year, in terms of a metric called the Day-Night Average Sound Level (DNL). However, DNL does not always provide a sufficient description of noise for many purposes. Other measures are available to address essentially any issue of concern. This section introduces the following acoustic metrics, which are all related to DNL, but provide bases for evaluating a broad range of noise situations.

- Decibel (dB);
- A-Weighted Decibel (dBA);
- Sound Exposure Level (SEL);
- Equivalent Sound Level (Leq);
- Time Above (TA);
- Time Above, Night (TAN); and
- DNL.

The Decibel (dB)
All sounds come from a sound source – a musical instrument, a voice speaking, or an airplane that passes overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in the form of sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear.

Our ears are sensitive to a wide range of sound pressures. The loudest sounds that we hear without pain have about one million times more energy than the quietest sounds we hear. However, our ears are incapable of detecting small differences in these pressures. Thus, to match how we hear this sound energy, we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level (SPL). SPL is a measure of the sound pressure of a given noise source relative to a standard reference value (typically the quietest sound that a young person with good hearing can detect). SPLs are measured in decibels (abbreviated dB). Decibels are logarithmic quantities – logarithms of the squared ratio of two pressures, the numerator being the pressure of the sound source of interest, and the denominator being the reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to SPL means that the quietest sound we can hear (the reference pressure) has a SPL of about zero decibels, while the loudest sounds we hear without pain have SPLs of about 120 dB. Most sounds in our day-to-day environment have SPLs from 30 to 100 dB.

Because decibels are logarithmic quantities, they do not behave like regular numbers with which we are more familiar. For example, if two sound sources each produce 100 dB and they are operated together, they produce only 103 dB – not 200 dB as we might expect. Four equal sources operating simultaneously result in a total SPL of 106 dB. In fact, for every doubling of the number of equal sources, the SPL goes up another three decibels.

A tenfold increase in the number of sources makes the SPL go up 10 dB. A hundredfold increase makes the level go up 20 dB, and it takes a thousand equal sources to increase the level 30 dB.

If one source is much louder than another source, the two sources together will produce the same SPL (and sound to our ears) as if the louder source were operating alone. For example, a 100 dB source plus an 80 dB source produces 100 dB when operating together. The louder source “masks” the quieter one, but if the quieter source gets louder, it will have an increasing effect on the total SPL. When the two sources are equal, as described above, they produce a level three decibels above the sound of either one by itself.

From these basic concepts, note that one hundred 80 dB sources will produce a combined level of 100 dB; if a single 100 dB source is added, the group will produce a total SPL of 103 dB. Clearly, the loudest source has the greatest effect on the total decibel level.

A-Weighted Decibel, dBA

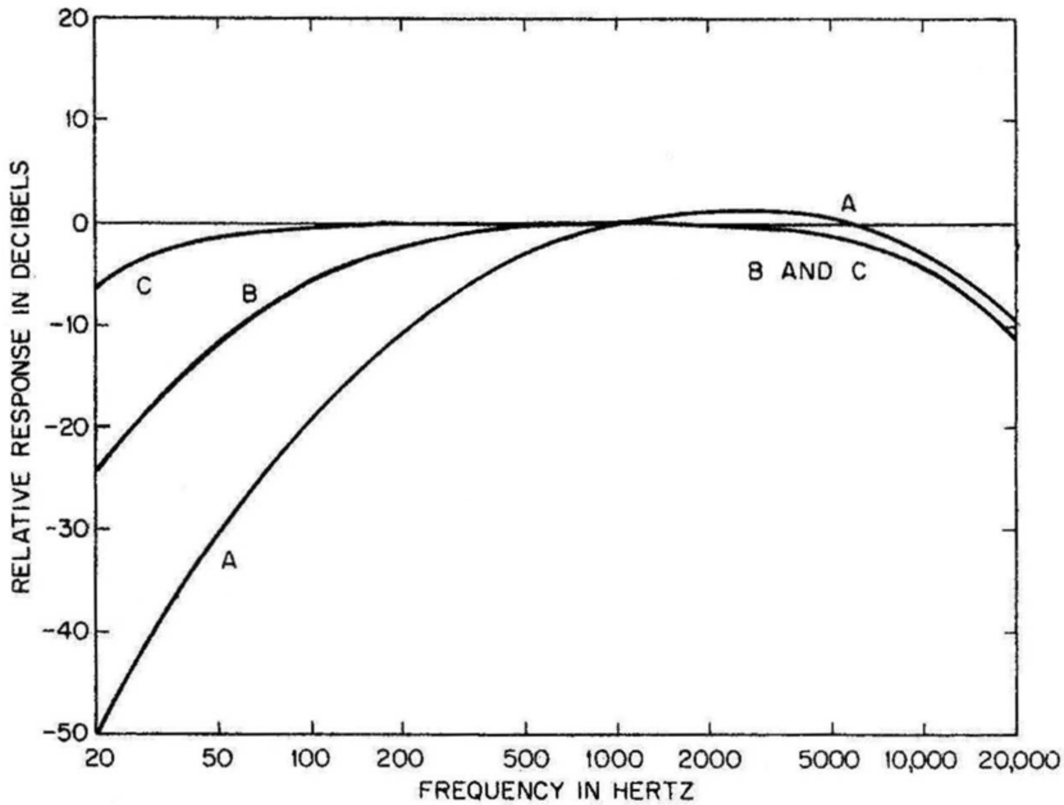
Another important characteristic of sound is its frequency, or “pitch.” This is the rate of repetition of the sound pressure oscillations as they reach our ear. Formerly expressed in cycles per second, frequency is now expressed in units known as Hertz (Hz).

Most people hear from about 20 Hz to about 10,000 to 15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, around 1,000 to 2,000 Hz. Acousticians have developed "filters" to match our ears' sensitivity and help us to judge the relative loudness of sounds made up of different frequencies. The so-called "A" filter does the best job of matching the sensitivity of our ears to most environmental noises. SPLs measured through this filter are referred to as A-weighted levels (dBA). A-weighting significantly de-emphasizes noise at low and very high frequencies (below about 500 Hz and above about 10,000 Hz) where we do not hear as well. Because this filter generally matches our ears' sensitivity, sounds having higher A-weighted sound levels are usually judged louder than those with lower A-weighted sound levels, a relationship which does not always hold true for unweighted levels. It is for these reasons that A-weighted sound levels are normally used to evaluate environmental noise.

Other weighting networks include the B and C filters. They correspond to different level ranges of the ear. The rarely used B-weighting attenuates low frequencies (those less than 500 Hz), but to a lesser degree than A-weighting. C weighting is nearly flat throughout the audible frequency range, hardly de-emphasizing low frequency noise. C-weighted levels can be preferable in evaluating sounds whose low-frequency components are responsible for secondary effects such as the shaking of a building, window rattle, or perceptible vibrations. Uses include the evaluation of blasting noise, artillery fire, and in some cases, aircraft noise inside buildings.

Figure H-1 compares these various weighting networks.

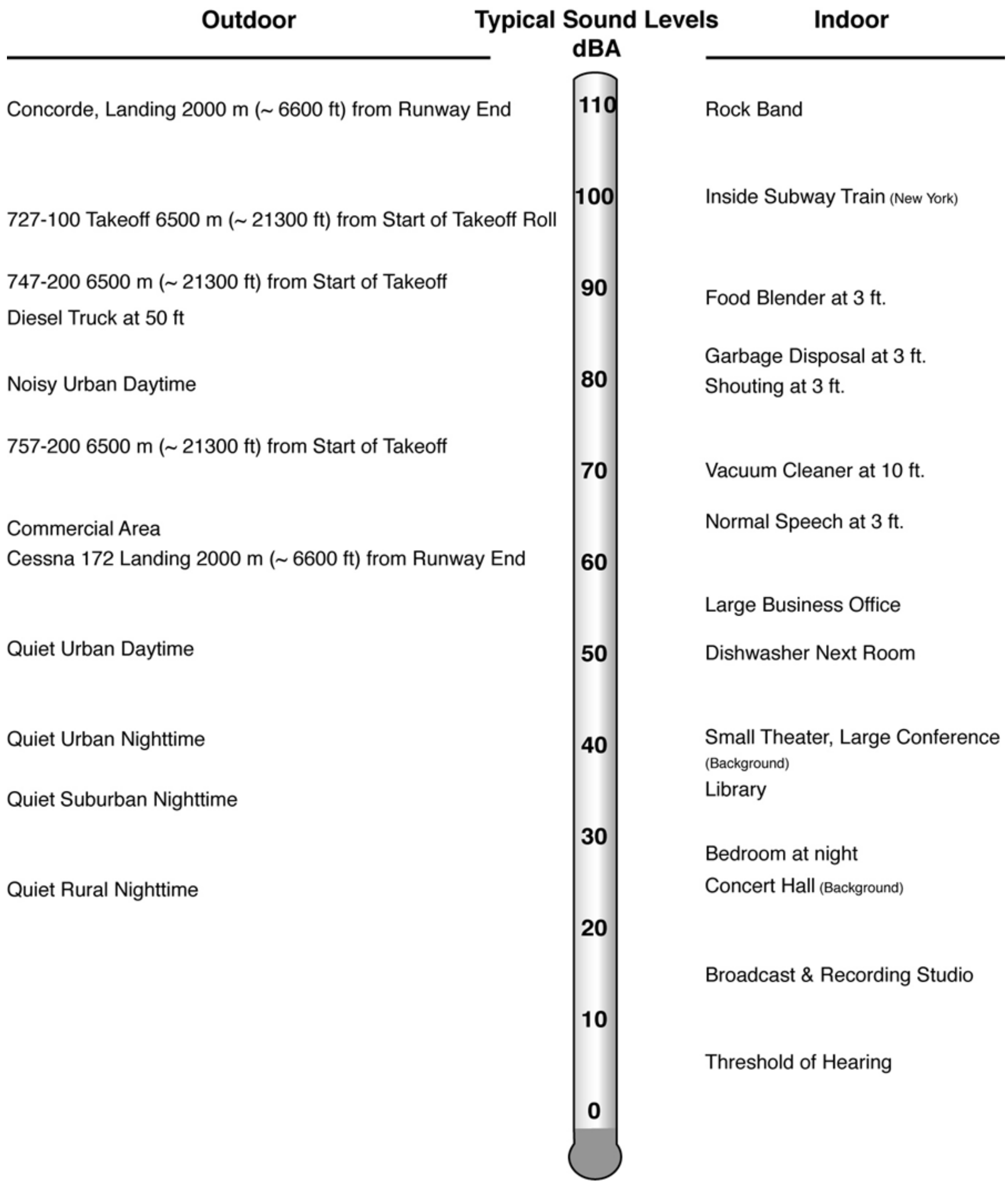
Figure H-1 Frequency-Response Characteristics of Various Weighting Networks



Source: Harris, Cyril M., editor; Handbook of Acoustical Measurements and Noise Control, (Chapter 5, "Acoustical Measurement Instruments"; Johnson, Daniel L.; Marsh, Alan H.; and Harris, Cyril M.); New York; McGraw-Hill, Inc.; 1991; p. 5.13.

Because of the correlation with our hearing, the A-weighted level has been adopted as the basic measure of environmental noise by the U.S. Environmental Protection Agency (EPA) and by nearly every other federal and state agency concerned with community noise. Figure H-2 presents typical A-weighted sound levels of several common environmental sources.

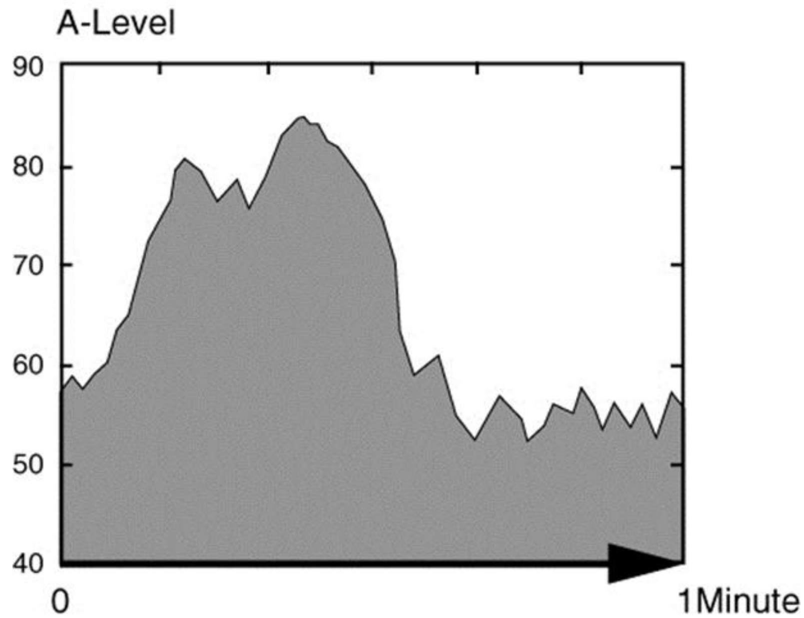
Figure H-2 Common Environmental Sound Levels, in dBA



Source: HMMH (Aircraft noise levels from FAA Advisory Circular 36-3H)

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (though even the background varies as birds chirp or the wind blows or a vehicle passes by). Figure H-3 illustrates this concept.

Figure H-3 Variations in the A-Weighted Sound Level Over Time



Source: HMMH

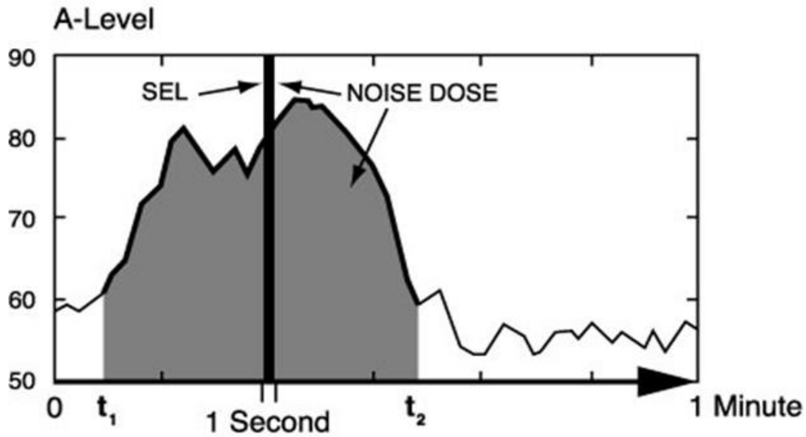
Maximum A-Weighted Noise Level, L_{max}
The variation in noise level over time often makes it convenient to describe a particular noise "event" by its maximum sound level, abbreviated as L_{max}. In the figure above, it is approximately 85 dBA.

The maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure. In fact, two events with identical maxima may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The next measure corrects for this deficiency.

Sound Exposure Level (SEL)
The most frequently used measure of noise exposure for an individual aircraft noise event (and the measure that Part 150 specifies for this purpose) is the SEL. SEL is a measure of the total noise energy produced during an event, from the time when the A-weighted sound level first exceeds a threshold level (normally just above the background or ambient noise) to the time that the sound level drops back down below the threshold. To allow comparison of noise events with very different durations, SEL "normalizes" the duration in every case to one second; that is, it is expressed as the steady noise level with just a one-second duration that includes the same amount of noise energy as the actual longer duration, time-varying noise. In lay terms, SEL "squeezes" the entire noise event into one second.

Figure H-4 depicts this transformation. The shaded area represents the energy included in an SEL measurement for the noise event, where the threshold is set to 60 dBA. The dark shaded vertical bar, which is 90 dBA high and just one second long (wide), contains exactly the same sound energy as the full event.

Figure H-4 Sound Exposure Level (SEL)



Source: HMMH

Because the SEL is normalized to one second, it will always be larger than the L_{max} for an event longer than one second. In this case, the SEL is 90 dB; the L_{max} is approximately 85 dBA. For most aircraft overflights, the SEL is normally on the order of 7 to 12 dB higher than L_{max}. Because SEL considers duration, longer exposure to relatively slow, quiet aircraft, such as propeller models, can have the same or higher SEL than shorter exposure to faster, louder planes, such as corporate jets.

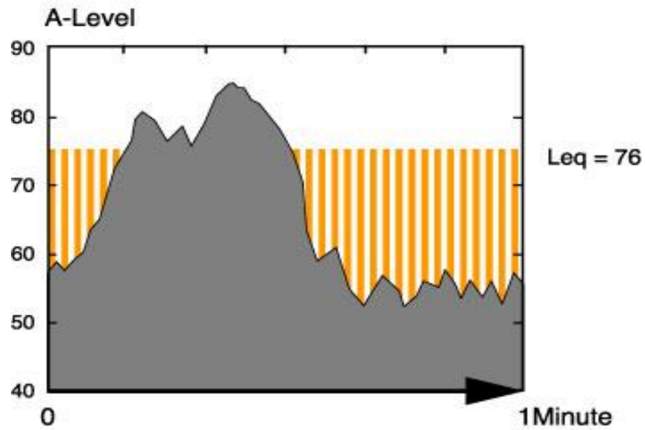
Equivalent Sound Level (L_{eq})

The L_{max} and SEL quantify the noise associated with individual events. The remaining metrics in this section describe longer-term cumulative noise exposure that can include many events.

The Equivalent Sound Level (L_{eq}) is a measure of exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest (e.g., an hour, an eight-hour school day, nighttime, or a full 24-hour day). Because the length of the period can differ, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq(8)}$ or $L_{eq(24)}$.

L_{eq} is equivalent to the constant sound level over the period of interest that contains as much sound energy as the actual time-varying level. This is illustrated in Figure H-5. Both the solid and striped shaded areas have a one-minute L_{eq} value of 76 dB. It is important to recognize, however, that the two signals (the constant one and the time-varying one) would sound very different in real life. Also, be aware that the "average" sound level suggested by L_{eq} is not an arithmetic value, but a logarithmic, or "energy-averaged" sound level. Thus, loud events dominate L_{eq} measurements.

Figure H-5 Example of a One Minute Equivalent Sound Level (L_{eq})



Source: HMMH

In airport noise studies, L_{eq} is often presented for consecutive one-hour periods to illustrate how the exposure rises and falls throughout a 24-hour period, and how individual hours are affected by unusual activity, such as rush hour traffic or a few loud aircraft.

Time Above (TA)

TA is a metric that gives the duration, in minutes, for which aircraft-related noise exceeds a specified A-weighted sound level during a given period. The measure is referred to generally as TA. For this *2014 EDR*, three threshold sound levels are used in the analysis: 65, 75, and 85 dBA. These times are computed using the Federal Aviation Administration (FAA)-approved Integrated Noise Model (INM).

Time Above Night (TAN)

Identical to TA, except it is computed for only the 9-hour period between 10:00 PM and 7:00 AM. The TAN is also developed using three threshold sound levels 65, 75, and 85 dBA.

Day-Night Average Sound Level (DNL)

Virtually all studies of aircraft noise rely on a slightly more complicated measure of noise exposure that describes cumulative noise exposure during an average annual day: the DNL. The EPA identified DNL as the most appropriate means of evaluating airport noise based on the following considerations:[1]

- 1. The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods.
- 2. The measure should correlate well with known effects of the noise environment and on individuals and the public.
- 3. The measure should be simple, practical, and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.
- 4. The required measurement equipment, with standard characteristics, should be commercially available.
- 5. The measure should be closely related to existing methods currently in use.

1 Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," U. S. EPA Report No. 550/9-74-004, March 1974

- 6. The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.
- 7. The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods.

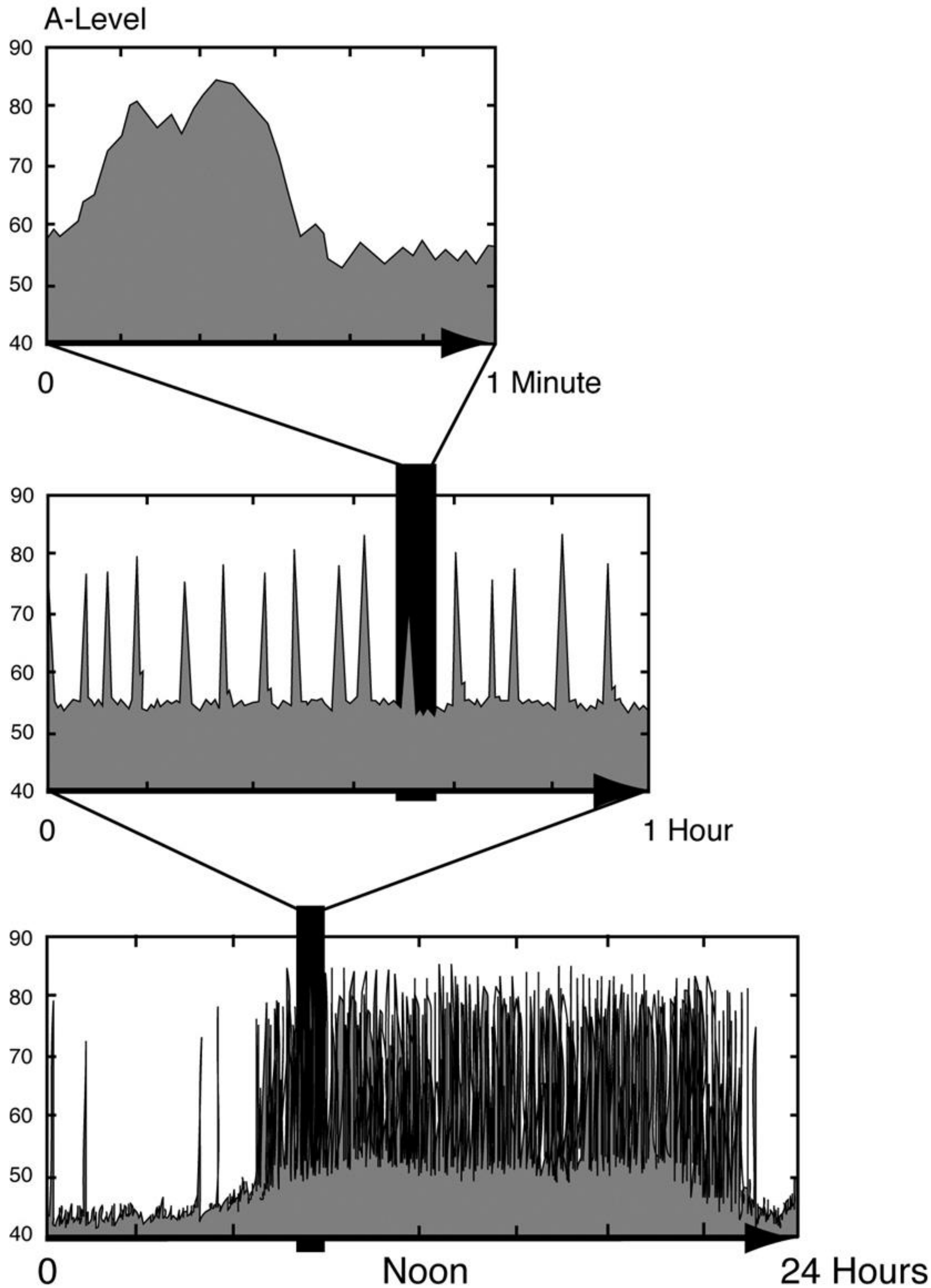
Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated; "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric."

The DNL represents noise as it occurs over a 24-hour period, with one important exception: DNL treats nighttime noise differently from daytime noise. In determining DNL, it is assumed that the A-weighted levels occurring at night (defined as 10:00 PM to 7:00 AM) are 10 dB louder than they really are. This 10 dB penalty is applied to account for greater sensitivity to nighttime noise, and the fact that events at night are often perceived to be more intrusive because nighttime ambient noise is less than daytime ambient noise.

Figure H-4 illustrated the A-weighted sound level due to an aircraft fly-over as it changed with time. The top frame of Figure H-6 repeats this figure. The shaded area reflects the noise dose that a listener receives during the one-minute period of the sample. The center frame of Figure H-4 includes this one-minute sample within a full hour. The shaded area represents the noise during that hour with 16 noise events, each producing an SEL. Similarly, the bottom frame includes the one-hour interval within a full 24 hours. Here the shaded area represents the listener's noise dose over a complete day. Note that several overflights occur at a time when the background noise drops some 10 dB, to approximately 45 dBA.

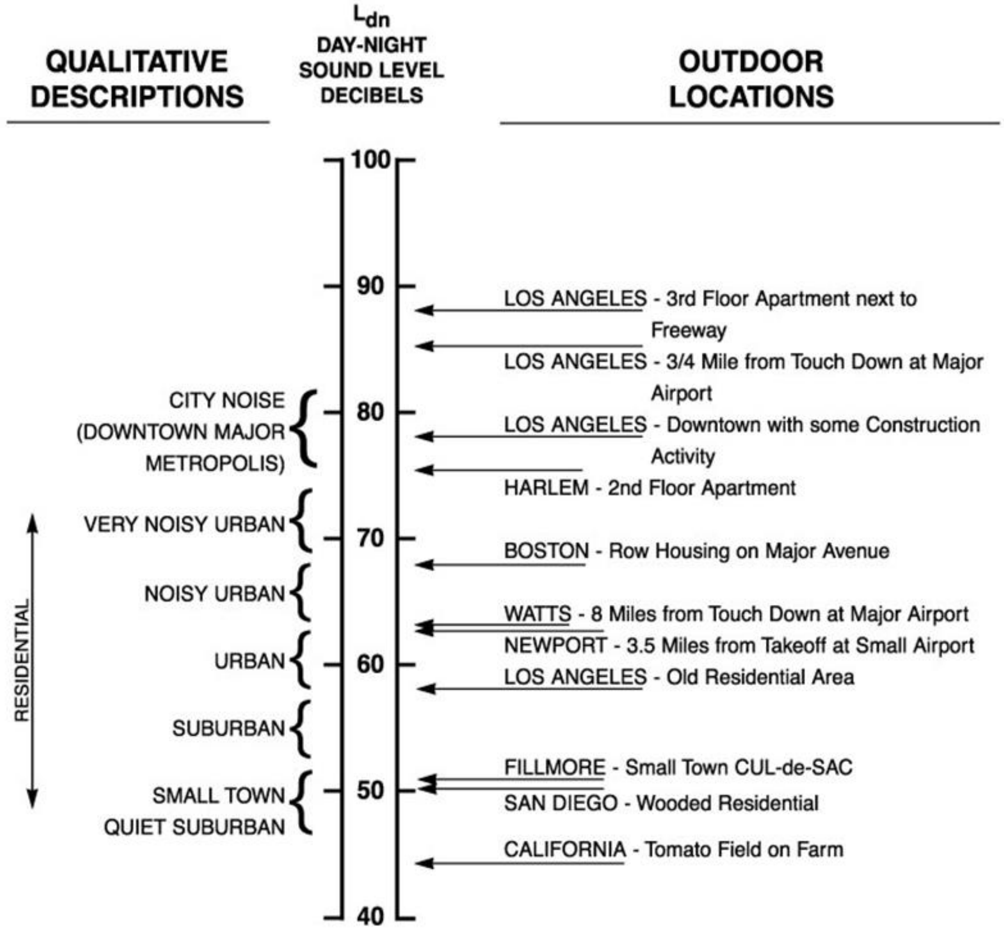
DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for relatively limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short time periods. Most airport noise studies are based on computer-generated DNL estimates, determined by accounting for all of the SELs from individual events, which comprise the total noise dose at a given location. Computed DNL values are often depicted in terms of equal-exposure noise contours (much as topographic maps have contours of equal elevation). Figure H-7 depicts typical DNL values for a variety of noise environments.

Figure H-6 Daily Noise Dose



Source: HMMH

Figure H-7 Examples of Day-Night Average Sound Levels (DNL)



Source: EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. 14.

As of May 2015, the FAA is beginning work on the next step in a multi-year Noise Research Program that will update the scientific evidence on the relationship between aircraft noise exposure and its effects on communities around airports. If changes are warranted, FAA will propose revised policy and related guidance and regulations, subject to interagency coordination, as well as public review and comment.

The Effects of Aircraft Noise on People

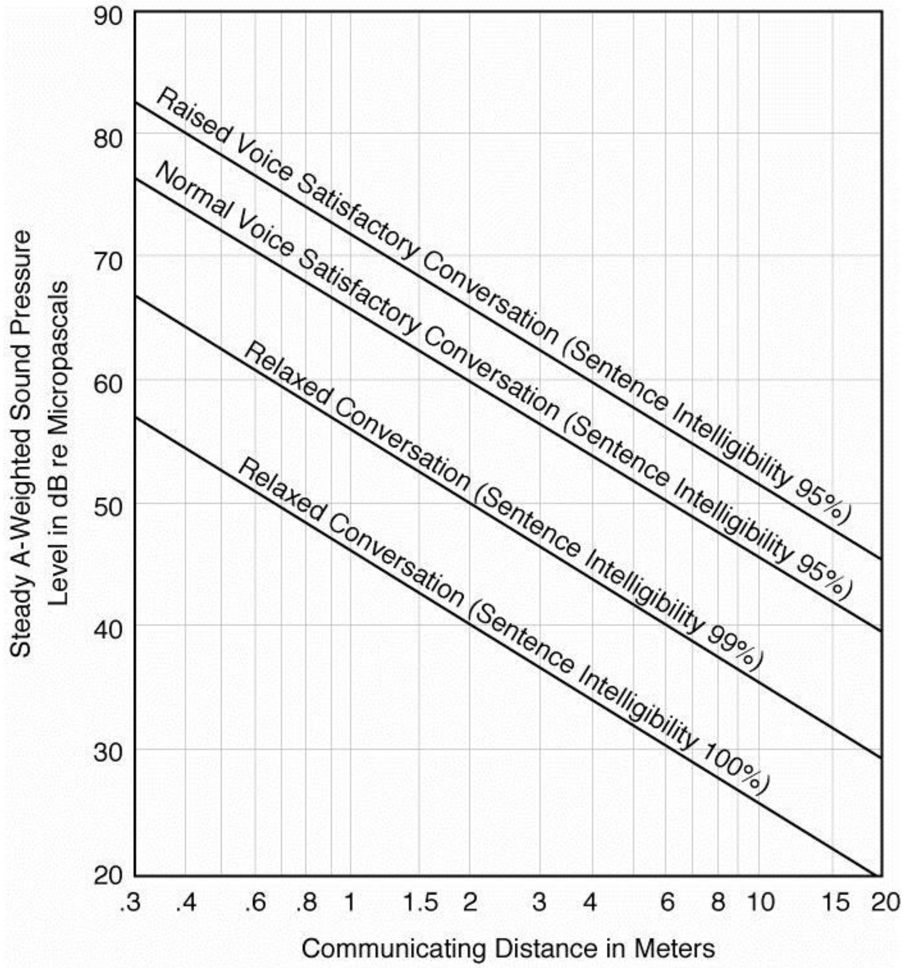
To residents around airports, aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, it can disrupt classroom activities in schools, and it can disrupt sleep. Relating these effects to specific noise metrics helps in the understanding of how and why people react to their environment.

Speech Interference

A primary effect of aircraft noise is its tendency to drown out or "mask" speech, making it difficult to carry on a normal conversation. The sound level of speech decreases as the distance between a talker and listener increases. As the background sound level increases, it becomes harder to hear speech. Figure H-8 presents typical distances between talker and listener for satisfactory outdoor conversations, in the presence of different steady A-weighted background noise levels for raised, normal, and relaxed voice effort. As the background

level increases, the talker must raise his/her voice, or the individuals must get closer together to continue talking.

Figure H-8 Outdoor Speech Intelligibility



Source: EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p. D-5.

As indicated in the figure, "satisfactory conversation" does not always require hearing every word; 95 percent intelligibility is acceptable for many conversations. Listeners can infer a few unheard words when they occur in a familiar context. However, in relaxed conversation, we have higher expectations of hearing speech and generally require closer to 100 percent intelligibility. Any combination of talker-listener distances and background noise that falls below the bottom line in Figure H-8 (thus assuring 100 percent intelligibility) represents an ideal environment for outdoor speech communication and is considered necessary for acceptable indoor conversation as well.

One implication of the relationships in Figure H-8 is that for typical communication at distances of 3 or 4 feet (1 to 1.5 meters), acceptable outdoor conversations can be carried on in a normal voice as long as the background noise outdoors is less than about 65 dBA. If the noise exceeds this level, as might occur when an aircraft passes overhead, intelligibility would be lost unless vocal effort were increased or communication distance were decreased.

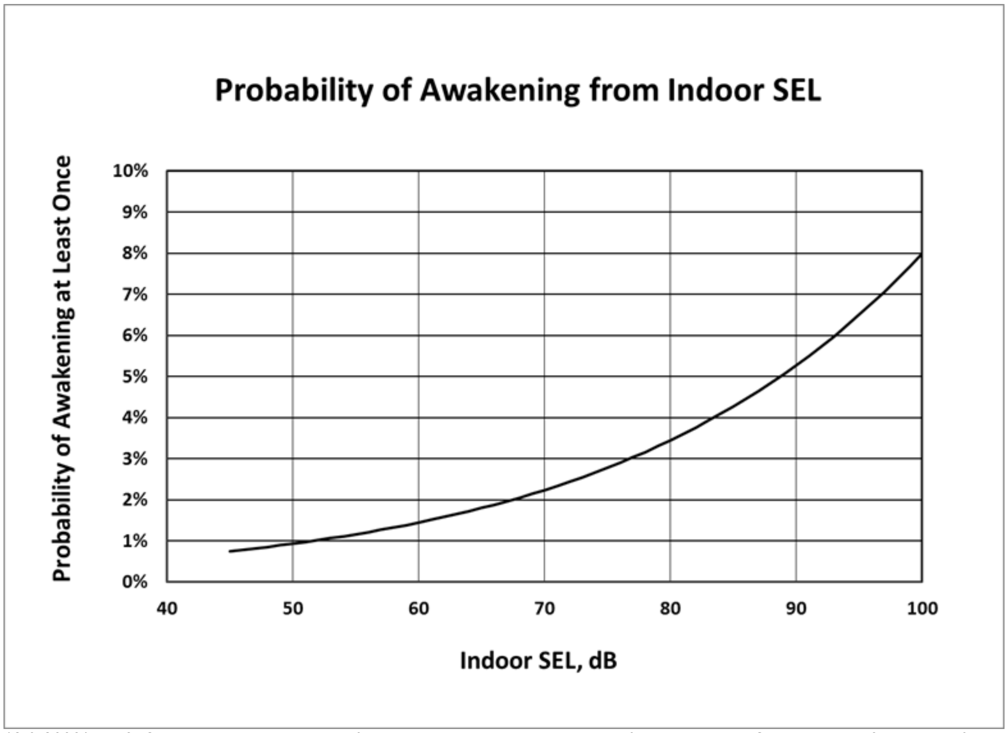
Indoors, typical distances, voice levels, and intelligibility expectations generally require a background level less than 45 dBA. With windows partly open, housing generally provides about 12 dBA of interior-to-exterior

noise level reduction. Thus, if the outdoor sound level is 60 dBA or less, there is a reasonable chance that the resulting indoor sound level will afford acceptable conversation inside. With windows closed, 24 dB of attenuation is typical.

Sleep Interference

Research on sleep disruption from noise has led to widely varying observations. In part, this is because (1) sleep can be disturbed without awakening, (2) the deeper the sleep the more noise it takes to cause arousal, and (3) the tendency to awaken increases with age, and other factors. Figure H-9 shows one such relationship from recent research conducted in the U.S. – the probability that a group of people will be awakened at least once when exposed to a given indoor SEL.

Figure H-9 Probability of Awakening at Least Once from Indoor Noise Event



Source: ANSI S12.9-2008/Part 6, Quantities and Procedures for Description and Measurement of Environmental Sound — Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes; Equation 1

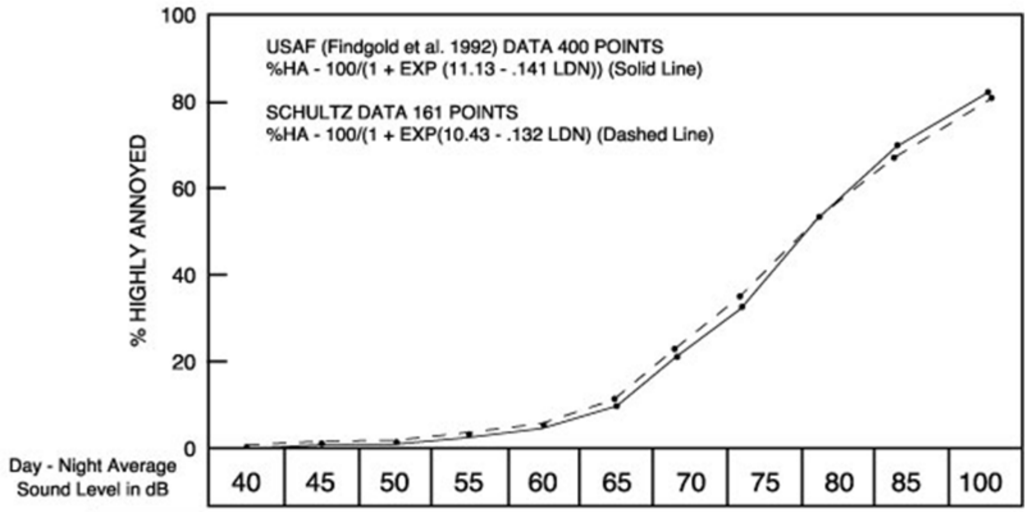
For example, an indoor SEL of 80 dB results in approximately 3.5 percent of the exposed population being awakened. If windows are open in the bedroom on a warm evening and a house provides a typical outside-to-inside noise level reduction of around 15 dB, which suggests it takes an SEL of about 95 dB outdoors to awaken 3.5 percent of the population. The American National Standards Institute (ANSI) has extended this concept further and developed a standard (ANSI S12.9-2008/Part 6) for computing the percentage of the population that is likely to be awakened by multiple noise events occurring throughout the night. The Federal Interagency Committee on Aviation Noise (FICAN) subsequently endorsed the standard as the best available means of estimating behavioral awakenings from aircraft noise.[2]

2 http://www.fican.org/pdf/FICAN_Sleep_Dec08.pdf

Community Annoyance

Social survey data make it clear that individual reactions to noise vary widely for a given noise level. Nevertheless, as a group, people's aggregate response is predictable and relates well to measures of cumulative noise exposure such as DNL. Figure H-10 shows a widely recognized relationship between environmental noise and annoyance.

Figure H-10 Percentage of People Highly Annoyed



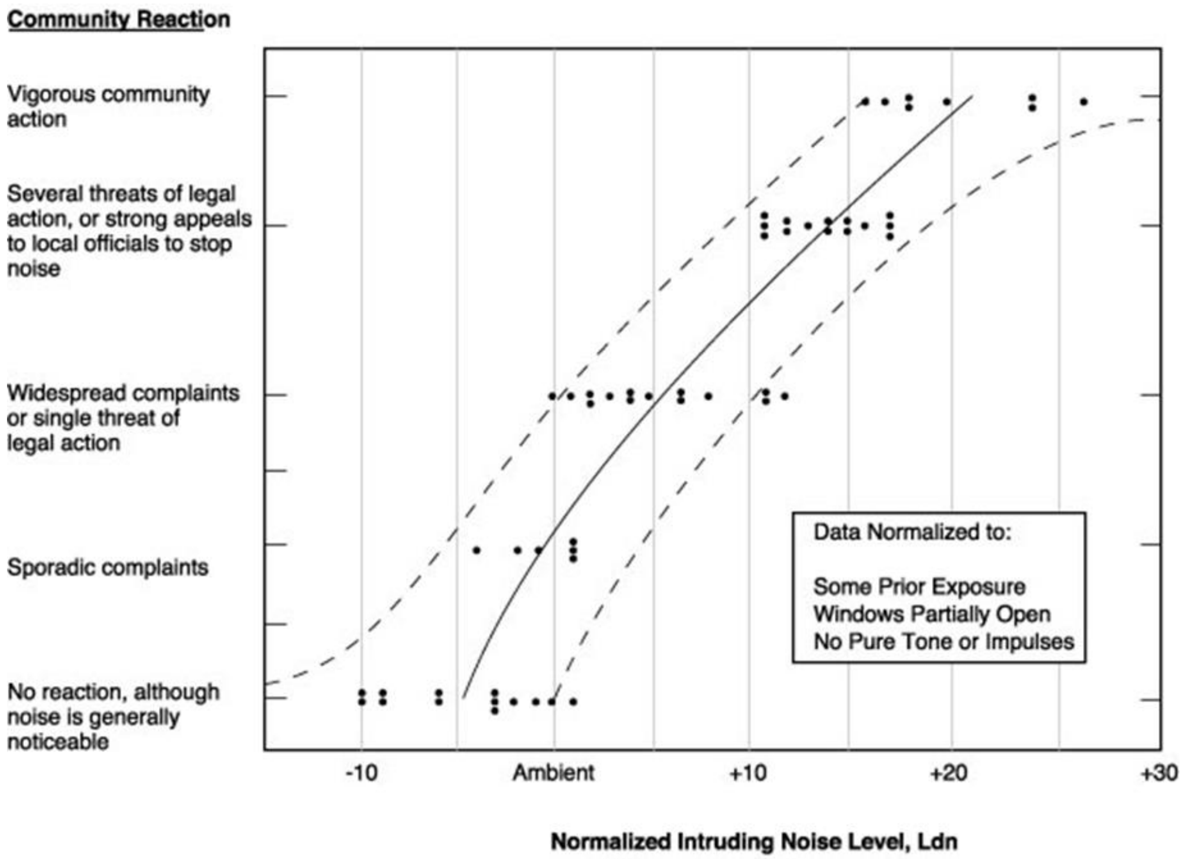
Day - Night Average Sound Level in dB		40	45	50	55	60	65	70	75	80	85	100
Calculated %HA Points	USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
	SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

Source: FICON. "Federal Agency Review of Selected Airport Noise Analysis Issues." August 1992. (From data provided by USAF Armstrong Laboratory). pp. 3-6.

Based on data from 18 surveys conducted worldwide, the curve indicates that at levels as low as DNL 55, approximately 5.0 percent of the people will still be highly annoyed, with the percentage increasing more rapidly as exposure increases above DNL 65.

Separate work by the EPA has shown that overall community reaction to a noise environment can also be related to DNL. This relationship is shown in Figure H-11. Levels have been normalized to the same set of exposure conditions to permit valid comparisons between ambient noise environments. Data summarized in Figure H-11 suggest that little reaction would be expected for intrusive noise levels five decibels below the ambient, while widespread complaints can be expected as intruding noise exceeds background levels by about five decibels. Vigorous action is likely when the background is exceeded by 20 dB.

Figure H-11 Community Reaction as a Function of Outdoor DNL



Source: Wyle Laboratories, "Community Noise," prepared for the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C., December 1971, pg. 63

Regulatory Framework

Logan Airport Noise Abatement Rules and Regulations

Massport's primary mechanism for reducing noise impacts from Logan Airport's operations is the Noise Rules.[3] The Noise Rules were designed to reduce noise impacts by encouraging use of quieter aircraft by requiring decreased use of noisier aircraft and by limiting nighttime activity by louder Stage 2 types. Many secondary goals aimed at limiting noise in specific areas also were stated.

Specific provisions of the Noise Rules, which continue to serve these goals, include:

- Limiting cumulative noise exposure at Logan Airport (as measured by Massport's CNI) to a maximum of 156.5 EPNdB
- Maximizing use of Stage 3 aircraft;
- Restricting nighttime operations by Stage 2 aircraft;
- Placing limitations on times and locations of engine run-ups and use of auxiliary power units (APU); and
- Restricting use of certain runways by noisier aircraft and time of day.

These restrictions and limitations are subject to FAA implementation and safe operation of the airport and airspace.

Federal Aviation Regulation (FAR) Part 36

Logan Airport operates within a framework of federal aviation regulations that limits an airport operator's ability to control noise. For example, the FAA's FAR Part 36[4] sets noise limits for aircraft certification and the procedures by which aircraft noise emission levels must be measured to determine compliance. The regulation defines noise emission limits for turbojets, turboprops, and helicopters, classifying turbojets into categories referred to as stages based on noise levels at each of three locations: takeoff, landing, and to the side of the runway during takeoff (sideline). The stages are:

- Stage 1 aircraft are the oldest and usually have the loudest operations, having preceded the existence of any noise emission regulation. Rare examples include old, restored civil or military aircraft. There are no Stage 1 aircraft operating at Logan Airport
- Stage 2 aircraft are less old and less noisy than Stage 1; they were the first aircraft types required to meet a noise limit. A subsequent regulation, FAR Part 91 (described in the next section), prohibits the operation of a Stage 2 aircraft in the continental U.S. unless its takeoff weight is 75,000 pounds or less. The FAA Reauthorization bill of 2012 also mandates the phase out of Stage 2 aircraft with a takeoff weight less than 75,000 pounds by 2015. In 2014, for the first time, there were no Stage 2 operations at Logan Airport which is a reduction from 2013 when less than 0.1 operations per day occurred (approximately 107 operations)
- Stage 3 aircraft were certified for service before 2006 and have relatively quiet jets, although some are Stage 2 aircraft that have been re-engined or have been fitted with hushkits that enable them to meet Stage 3 noise limits Stage 4 aircraft are the newest and quietest of the jets. These aircraft will be required to operate with noise levels at least 10 dB quieter than Stage 3 aircraft at three prescribed

3 The Logan International Airport Noise Abatement Rules and Regulations, effective July 1, 1986, are codified at 740 Code of Massachusetts Regulations (CMR) 24.01 et seq (also known as the Noise Rules).
4 14 CFR Part 36, "Noise Standards: Aircraft Type and Air Worthiness Certification."

measurement points. Jet aircraft certificated after January 1, 2006 must meet the Stage 4 limits. Although not required, the majority of aircraft in the 2014 Logan Airport fleet would also meet the new Stage 4 noise limits if they were recertificated.

FAR Part 150

First implemented in February 1981, FAR Part 150[5] defines procedures that an airport operator must follow if it chooses to conduct and implement an airport noise and land use compatibility plan. Part 150 Noise Compatibility studies require the use of DNL to evaluate the airport noise environment. FAR Part 150 identifies noise compatibility guidelines for different land uses depending on their sensitivity. Key values include a DNL of 75 dB, above which no residences, schools, hospitals, or churches are considered compatible, and a DNL of 65 dB, above which those land uses are considered compatible only if they are sound insulated.

Noise abatement or mitigation measures that an airport operator must consider in a Part 150 study include acquisition of incompatible land, construction of noise barriers, sound insulation of buildings, implementation of a preferential runway program, use of noise abatement flight tracks, implementation of airport use restrictions, and any other actions that would have a beneficial effect on the public.

While Massport has implemented variations of all of these and additional measures at Logan Airport, Massport has not filed an official Part 150 noise compatibility study with the FAA because all of Logan Airport's program elements, while regularly reviewed and updated, preceded the promulgation of Part 150 and are effectively grandfathered under the regulation.

FAR Parts 91 and 161

The Airport Noise and Capacity Act of 1990 (ANCA)[6] directed the U.S. Secretary of Transportation to undertake three key noise-related actions:

- Establish a schedule for a phase out of Part 36 Stage 2 aircraft by the year 2000
- Establish a program for FAA review of all new airport noise and access restrictions limiting operations of Stage 2 aircraft; and
- Establish a program for FAA review and approval of any restriction that limits operations of Stage 3 aircraft, including public notice requirements.

The FAA addressed these requirements through amendment of an existing federal regulation, "Part 91,"[7] and establishment of a new regulation, "Part 161."[8] ANCA effectively ended Massport's pursuit of any additional operational restrictions outside of this program.

Amendment to Part 91

The FAA establishes and regulates operating noise limits for civil aircraft operation in Subpart I, "Operating Noise Limits," of 14 CFR Part 91, "General Operating and Flight Rules." The noise limits are based on aircraft noise certification criteria set forth in 14 CFR Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification." For transport category "large" aircraft (with maximum takeoff weights of 12,500 pounds or more) and for all turbojet-powered aircraft, Part 36 identifies four "stages" of aircraft with respect to their relative noisiness:

5 14 CFR Part 150, "Airport Noise Compatibility Planning."
6 Pub. L. No. 101-508, 104 Stat. 1388, as recodified at 49 United States Code 47521- 47533.
7 14 CFR Part 91, "General Operating and Flight Rules."
8 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions."

- Stage 1 aircraft, which have never been shown to meet any noise standards, because they have never been tested, or because they have been tested and failed to meet any established standards
- Stage 2 aircraft, which meet original noise limits, set in 1969
- Stage 3 aircraft, which meet more stringent limits, established in 1977; and
- Stage 4 aircraft, which meet the most stringent limits, established in 2005.

In 1976, the FAA ordered a phase out of all Stage 1 aircraft with a maximum gross takeoff weight (MGTOW) over 75,000 pounds, to be completed on January 1, 1985. After that date, Stage 1 civil aircraft over 75,000 pounds MGTOW were banned from operating in the U.S. (with limited exemptions related to commercial service at "small communities," which has since expired in 1988). ANCA required a similar phase out of Stage 2 aircraft over 75,000 pounds by December 31, 1999. The 75,000-pound weight limit exempts most "business" (or "corporate") jets and a very small number of the very smallest "air carrier" type jets until December 31, 2015 when a full ban will take effect.[9] Aircraft operators responded to the Stage 1 and 2 phase outs by retiring their non-compliant aircraft or modifying some of their aircraft to meet the more stringent standards. The modifications undertaken include installation of quieter engines, noise-reducing physical modifications to the airframe and/or existing engines, and limitation of operating weights and procedures to meet the applicable Part 36 limits. Some former Stage 2 airline aircraft that were "recertificated" as Stage 3 with these modifications still operate at Logan Airport, but are generally declining due to the aircrafts' age and high operating costs (in particular due to the generally low fuel efficiency of these older aircraft).

As airlines add new aircraft, Stage 4 aircraft have been added to their fleets. The new Stage 4 noise standard applies to any new jet aircraft type designs over 12,500 pounds requiring FAA approval after January 1, 2006. The International Civil Aviation Organization (ICAO) has already adopted a similar regulation for international operators, but neither the FAA nor ICAO have indicated there will be restrictions on the remaining recertificated Stage 3 aircraft from carrier fleets.

Part 161

FAA implemented the ANCA requirements related to notice, analysis, and approval of use restrictions affecting Stage 2 and 3 aircraft through the establishment of a new regulation, 14 CFR Part 161, "Notice and Approval of Airport Noise and Access Restrictions." In simple terms, Part 161 requires an airport operator that proposes to implement a restriction on Stage 2 or 3 aircraft operations to undertake, document, and publicize certain benefit-cost analyses, comparing the noise benefits of the restriction to its economic costs. Operators must obtain specific FAA approvals of the analysis, documentation, and notice processes, and – for Stage 3 restrictions – approval of the restriction itself.

Part 161 and ANCA define more demanding requirements and explicit guidance for Stage 3 restrictions. To implement a Stage 3 restriction, formal FAA approval is required. The FAA's role for Stage 2 restrictions is limited to commenting on compliance with Part 161 notice and analysis procedural requirements. Part 161 provides guidance regarding appropriate information to provide in support of these findings. While Part 161 does not require this information for a Stage 2 restriction, Part 161 states that it would be "useful." Moreover, the FAA has required airports to provide this same information for Stage 2 restrictions (and even for Stage 1 restrictions pursued under FAR Part 150), on the grounds that they are required for airports to comply with grant assurance 22(a), "Economic Nondiscrimination," which states that an airport operator "will make its airport available as an airport for public use on reasonable terms and without unjust discrimination to all

9 The FAA Modernization and Reform Act of 2012 sets a January 1, 2016 ban of Stage 2 aircraft less than 75,000 lbs.

types, kinds, and classes of aeronautical activities, including commercial aeronautical activities offering services to the public at the Airport."[10]

Although several (on the order of a dozen) airports have embarked on efforts to adopt both Stage 2 and 3 restrictions in the past two decades, the FAA has found that only one, Naples Municipal Airport, a GA airport in Naples, Florida, has fully complied with Part 161 analysis, notice, and documentation requirements for a ban on Stage 2 jet operations. FAA found the airport was in violation of prior FAA grant assurances. The airport operator successfully sued the FAA to overturn that ruling and has implemented the restriction.

ANCA and Part 161 specifically exempt Stage 3 use restrictions that were effective on or before October 1, 1990 and Stage 2 restrictions that were proposed before that date. The Logan Airport Noise Rules were promulgated in 1986; therefore, ANCA and Part 161 have no bearing on their continued implementation in their current form. Any future proposals to make the rules more stringent with regard to Stage 2 operations or to restrict Stage 3 operations in any way would almost certainly trigger Part 161 notice, analysis, and approval processes for Stage 3 restrictions. In 2006, Massport requested an opinion from the FAA regarding the pursuit of a Part 161 waiver or exemption to allow Massport to implement a curfew of nighttime operations of hush-kitted Stage 3 aircraft. FAA informed Massport that a waiver or exemption from the requirements of Part 161 is not authorized under, or consistent with, federal statutory and regulatory requirements. A copy of FAA's letter to Massport was provided in *Appendix H, Noise Abatement* in the *2005 EDR.*

10 FAA Order 5190.6(b),"Airport Compliance Manual" Chapter 13, Section 14, paragraph (a). To be approved, restrictions must meet the following six statutory criteria: 1) The proposed restriction is reasonable, nonarbitrary, and nondiscriminatory. 2) The proposed restriction does not create an undue burden on interstate or foreign commerce. 3) The proposed restriction maintains safe and efficient use of the navigable airspace. 4) The proposed restriction does not conflict with any existing federal statute or regulation. 5) The applicant has provided adequate opportunity for public comment on the proposed restriction. 6) The proposed restriction does not create an undue burden on the national aviation system.

Logan Airport RealContours™ Data Inputs

To relate portions of the foregoing discussion to the specific noise environment around Logan Airport, for this *2014 EDR*, the Massachusetts Port Authority (Massport) has produced a set of DNL noise contours, TA noise metrics, and population counts for 2014 using the pair of software packages RealProfiles™ and RealContours™. This software takes radar data from individual flights occurring throughout the year, processes the information and formats it into a form usable as input to the latest version of the FAA's INM, which serves as the computational "engine" for calculating noise. Version 7.0d was used for 2014, incorporating improvements in the updated version of the INM that became available at the end of that year. The RealProfiles™ and RealContours™ system used the individual flight tracks taken directly from the Massport Noise and Operations Management System (NOMS) rather than relying on consolidated data summaries. For 2013, the NOMS retained suitable data for 347,216 flights; all of these were used in the INM noise model directly. For 2014, the NOMS retained suitable data for 345,090 flights; all of these were used in the noise model directly.

Overview

Standard INM input methodology involves development of operational inputs and calculation of the DNL for a prototypical average annual day.[11] This approach requires manually collecting, refining, and entering the enormous amount of data averaged over a full year of activity at an airport. Typically, the model inputs may include an aircraft fleet mix with several dozen representative aircraft types, on the order of 100 to 300 representative flight tracks (common for a facility the size of Logan Airport), and runway use and flight track use percentages for three or four categories of aircraft types with similar performance characteristics.

This normal approach to noise modeling meets accepted professional standards, and reduces the effort and cost that would be associated with manually entering the parameters for every actual operation. However, it represents a significant simplification of the extraordinary diversity of actual aircraft operations over a year. It also does not take full advantage of the investment that Massport has made in installing and maintaining a state-of-the-art radar system,[12] which automatically collects flight track data and flight identification data for all operations at the Airport and feeds the NOMS.

Instead, for this report, Massport has utilized an INM pre-processor, RealContours™, which takes maximum possible advantage of both the INM's capabilities and the investment that Massport has made in operations monitoring. RealContours™ automates the process of preparing the INM inputs directly from the actual flight operations, and permits airports to model the full diversity of activity as precisely as possible, at a cost equivalent to the more simplified manual approach. RealContours™ improves the precision of modeling by utilizing operations monitoring results in five key areas:

- Directly converts the flight track for every identified aircraft operation to an INM track, rather than assigning multiple operations to a limited number of prototypical tracks.
- Models each operation on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types.
- Models each operation in the period that it occurred, which takes into account delays at the Airport during the year.
- Selects the specific airframe and engine combination to model, on an operation-by-operation basis, based on the registration data for each flight wherever possible; otherwise, the published compositions of the fleets of the specific airlines operating at Logan Airport are used.

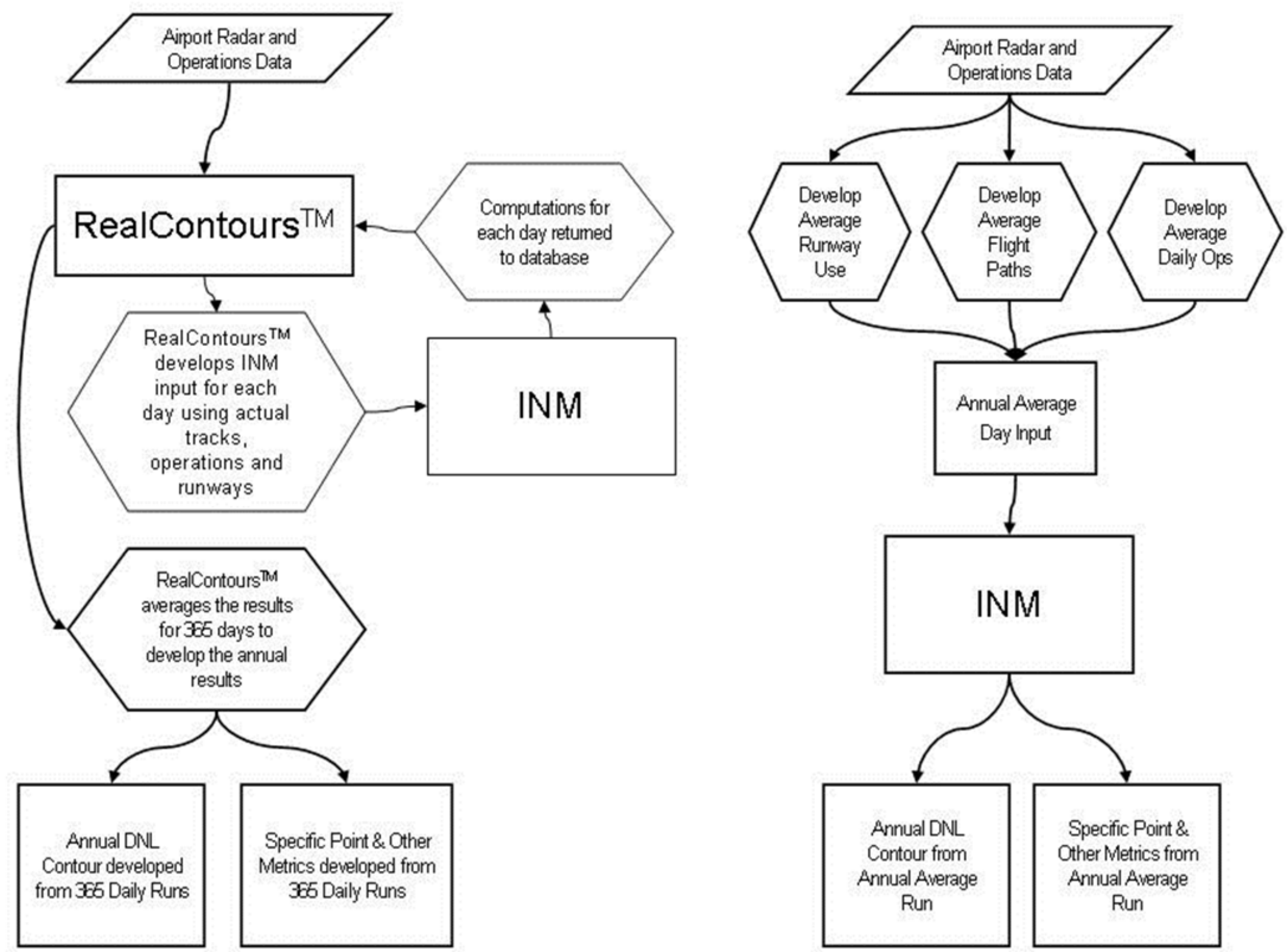
11 FAA INM Version 7.0 User's Guide, April 2007, p. 12.
12 Starting in 2010, the Massport system utilized the Airscene.com product of Era Corporation. The radar data remains the same but the system is now provided by Exelis.

- Uses each aircraft's actual performance and altitude profile to develop inputs to the model, which define the actual climb, descent, and speed profile for every operation.

RealContours™ completes the task of computing noise by running the INM in the middle of the night to obtain DNL or other noise metrics for the previous day's operations, and then averages the results to obtain the annual contour.

Figure H-12 provides a schematic representation of the RealContours™ noise modeling process compared to the standard INM process.

Figure H-12 Schematic Noise Modeling Process (Standard INM vs. RealContours™)



Source: FAA, HMMH

INM v7.0d Model

- The FAA's INMv7.0d was released for general use on May 23, 2013 with a Software Service Update on September 24, 2013. The latest version has been used for the 2013 and 2014 DNL contour in this report as the primary analytical tool to assess the noise environment at Logan Airport. This version of the model includes data for the Boeing 787-8R, Embraer E170, and Embraer E190, all types in use at Logan Airport.

The remaining sections of this appendix provide several tables describing the data for 2014. Where possible, the data for 2013 are included for comparison and in general the tables listed as (a) are for 2013 and (b) for 2014.

2014 Radar Data

- Logan Airport's radar data provide the key to the RealContours™ system. Since February 2004, Massport has collected Passive Surveillance Radar System (PASSUR) radar data, which supplies information to the Airport's web-based Airport Monitor software. This dataset was used for the *2004 Environmental Status and Planning Report (2004 ESPR)* through the *2008 EDR*. Beginning with the *2009 EDR*, Massport began utilizing the radar data from its Exelis NOMS system. These radar data are obtained from a multilateration system of eight sensors deployed around the Airport. The positioning data from all of these sensors are correlated to provide better, more accurate coverage of aircraft (in areas where the traditional FAA radar has limitations) and provide a more complete set of points to define each track. Traditional radar provides points every four to five seconds where the multilateration system provides data every second. The system was able to collect 365 complete days of data for 2014 with approximately 97 percent of these tracks usable for the development of the noise exposure contours.

Fleet Mix

The 2014 radar data was first processed to establish a baseline set of operations. After processing the 365 days of radar data (345,090 operations), flight tracks with sufficient operational information were identified to use as the baseline for the 2014 contours. The operations from these tracks were then scaled upwards by airline and aircraft type to match the reported totals provided by Massport for 2014. Tables H-1a (2013 for comparison) and H-1b (2014) provide the scaled annual operations, by INM aircraft type. Each INM type listed in Tables H-1a and H-1b is also mapped to a Runway Use group based on its weight and performance characteristics described in the Runway Use section below.

Runway Use

RealContours™ determines which runway was used by each aircraft type and whether it was a daytime or nighttime operation directly from the radar data. The summary of daytime and nighttime runway usages presented here is broken into six representative aircraft groups listed below, grouped in this format to allow comparison with prior years (see Tables H-2a and H-2b):

- Heavy Jet A – B747s, A340s, DC-8s;
- Heavy Jet B – B767s, B777s, A300s, A310s, A330s, DC-10s, L1011s, MD-11s;
- Light Jet A – B717s, B727s, DC-9s, F100s, MD-90s;
- Light Jet B – B737s, B757s, A319s, A320s, B-146s, MD-80s, E190;
- Regional Jet (RJ) – E135, E145, E170, CRJ2, CRJ7, CRJ9, J328 and Corporate Jets; and
- Turboprops and Piston Aircraft (non-jets).

Table H-1a 2013 Annual Modeled Operations

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
Commercial Jet Operations						
747400	Heavy Jet A	1,026.0	8.9	966.1	68.8	2,069.8
A340-211	Heavy Jet A	629.1	4.4	380.0	253.6	1,267.1
A340-642	Heavy Jet A	428.8	0.0	404.5	24.4	857.7
A380-841	Heavy Jet A	1.6	0.0	1.6	0.0	3.2
767300	Heavy Jet B	363.0	206.1	359.6	209.5	1,138.2
767400	Heavy Jet B	99.1	3.2	97.3	5.1	204.7
767CF6	Heavy Jet B	94.0	74.3	14.2	154.1	336.6
767JT9	Heavy Jet B	40.0	60.5	0.0	100.5	201.0
777200	Heavy Jet B	899.1	150.7	754.0	295.9	2,099.7
777300	Heavy Jet B	1.6	0.0	1.6	0.0	3.2
7773ER (New INMv7.0d type)	Heavy Jet B	14.0	0.0	5.7	8.2	27.9
7878R (New INMv7.0d type)	Heavy Jet B	227.1	0.0	227.1	0.0	454.2
A300-622R	Heavy Jet B	174.2	485.0	308.8	350.4	1,318.4
A310-304	Heavy Jet B	241.6	4.0	43.6	202.1	491.3
A330-301	Heavy Jet B	1,466.7	8.6	1,394.9	80.4	2,950.6
A330-343	Heavy Jet B	644.6	5.4	556.3	93.7	1,300.0
DC1010	Heavy Jet B	190.8	177.5	60.9	307.4	736.6
DC1030	Heavy Jet B	52.2	59.9	22.4	89.7	224.2
MD11GE	Heavy Jet B	198.5	155.3	175.9	177.9	707.6
MD11PW	Heavy Jet B	117.0	84.1	98.4	102.7	402.2
717200	Light Jet A	2,963.4	836.4	3,042.2	757.6	7,599.6
727EM2	Light Jet A	9.4	3.9	7.4	5.8	26.5
DC95HW	Light Jet A	6.1	0.0	6.1	0.0	12.2
F10062	Light Jet A	36.5	1.0	36.8	6.0	80.3
MD9025	Light Jet A	710.8	23.3	708.1	26.0	1,468.2
MD9028	Light Jet A	341.1	15.8	339.7	17.2	713.8
737300	Light Jet B	1,303.8	199.2	1,348.1	154.9	3006
7373B2	Light Jet B	79.6	12.3	77.9	14.0	183.8
737400	Light Jet B	173.0	38.4	171.2	40.2	422.8
737500	Light Jet B	42.3	0.0	38.3	4.0	84.6
737700	Light Jet B	5,808.8	1,553.0	6,626.2	735.7	14,723.7
737800	Light Jet B	12,504.3	4,214.7	14,542.0	2,177.1	33,438.1
737N17	Light Jet B	0.0	1.6	1.6	0.0	3.2
757300	Light Jet B	86.2	23.7	104.6	5.2	219.7
757PW	Light Jet B	2,853.7	692.6	2,975.0	570.2	7,091.5
757RR	Light Jet B	4,480.5	1,275.4	4,918.8	838.1	11,512.8
A319-131	Light Jet B	8,683.6	2,311.1	9,265.6	1,729.1	21,989.4
A320-211	Light Jet B	4,569.1	778.9	4,718.2	629.8	10,696.0
A320-232	Light Jet B	17,358.8	5,674.2	19,869.9	3,163.1	46,066.0
A321-232	Light Jet B	1,507.9	585.4	1697.0	396.3	4,186.6
EMB190 (New INMv7.0d type)	Light Jet B	25,687.9	2,380.4	24,967.2	3,101.1	56,136.6
EMB195 (New INMv7.0d type)	Light Jet B	15.2	1.1	13.2	3.0	32.5
MD82	Light Jet B	11.1	0.0	10.1	1.0	22.2

Note: Some totals may not match due to rounding.

Table H-1a 2013 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
Commercial Jet Operations (Continued)						
MD83	Light Jet B	994.1	43.8	966.5	71.4	2,075.8
CIT3	RJ	2.2	0.0	1.0	1.0	4.2
CL600	RJ	14.0	2.0	21.1	0.0	37.1
CL601	RJ	6,256.2	361.0	6,426.7	191.5	13,235.4
CNA525C	RJ	6.0	1.0	7.3	0.0	14.3
CNA55B	RJ	10.0	1.0	10.2	1.0	22.2
CNA560E	RJ	5.0	0.0	5.4	0.0	10.4
CNA560U	RJ	3.0	1.0	2.4	1.2	7.6
CNA560XL	RJ	7.3	0.0	4.0	1.0	12.3
CNA680	RJ	3.0	0.0	3.0	0.0	6.0
CNA750	RJ	3.0	0.0	3.0	0.0	6.0
CRJ9-ER	RJ	3,514.5	143.1	3,228.5	429.0	7,315.1
CRJ9-LR	RJ	986.6	51.9	907.2	131.2	2,076.9
EMB145	RJ	96.8	1.0	91.1	6.7	195.6
EMB14L	RJ	2,141.9	41.5	1,968.0	215.4	4,366.8
EMB170 (New INMv7.0d type)	RJ	5,315.0	395.8	5,208.1	502.7	11,421.6
EMB175 (New INMv7.0d type)	RJ	3,998.2	212.3	3,789.2	421.3	8,421.0
GIIB	RJ	2.0	0.0	2.3	0.0	4.3
GIV	RJ	30.0	2.0	28.8	3.0	63.8
GV	RJ	19.0	2.1	19.0	2.0	42.1
IA1125	RJ	3.1	0.0	3.0	0.0	6.1
LEAR25	RJ	0.0	1.0	0.0	0.0	1.0
LEAR35	RJ	34.9	30.0	43.4	29.0	137.3
MU3001	RJ	6.0	1.0	6.0	0.0	13.0
Commercial Jets Subtotal		**119,591.7**	**23401.8**	**124,102.3**	**18,906.2**	**286,002.0**
Commercial Non-Jet Operations						
BEC58P	Non-jet	17,981.3	627.2	18,445.8	163.2	37,217.5
CNA206	Non-jet	0.0	1.0	0.0	0.0	1.0
CNA208	Non-jet	230.6	2.1	226.8	1.0	460.5
CNA441	Non-jet	51.3	19.5	62.0	6.0	138.8
DHC6	Non-jet	8.4	9.6	14.0	3.0	35.0
DHC8	Non-jet	1,326.8	10.4	1,323.8	13.4	2,674.4
DHC830	Non-jet	2,193.6	71.5	2,083.2	181.9	4,530.2
DO228	Non-jet	4.2	0.0	5.0	1.0	10.2
DO328	Non-jet	4.2	0.0	4.2	0.0	8.4
GASEPF	Non-jet	1.0	0.0	0.0	1.0	2.0
PA31	Non-jet	1.0	2.0	2.4	3.6	9.0
SF340	Non-jet	2,147.3	44.7	2,183.7	8.3	4,384.0
Commercial Non-Jet Operations Subtotal		**23,951.9**	**788.0**	**24,351.9**	**383.4**	**49,475.2**
Commercial Aircraft Total		**143,543.6**	**24,189.8**	**148,454.2**	**19,289.6**	**335,477.2**

Table H-1a 2013 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
General Aviation Operations						
747200	Heavy Jet A	1.1	0.0	1.1	0.0	2.2
74720B	Heavy Jet A	2.2	0.0	2.2	0.0	4.4
767300	Heavy Jet B	4.3	0.0	2.2	2.2	8.7
767CF6	Heavy Jet B	1.1	0.0	1.1	0.0	2.2
A330-301	Heavy Jet B	2.2	0.0	2.2	0.0	4.4
C17	Heavy Jet B	4.3	0.0	4.3	0.0	8.6
KC135R	Heavy Jet B	1.1	0.0	1.1	0.0	2.2
727EM2	Light Jet A	1.1	2.2	0.0	3.3	6.6
DC93LW	Light Jet A	0.0	3.3	0.0	3.3	6.6
DC95HW	Light Jet A	1.1	0.0	0.0	1.1	2.2
737400	Light Jet B	13.0	0.0	6.5	6.5	26.0
737500	Light Jet B	1.1	0.0	1.1	0.0	2.2
737700	Light Jet B	19.4	1.2	17.4	3.3	41.3
737800	Light Jet B	21.7	6.5	26.0	2.2	56.4
757PW	Light Jet B	4.4	0.0	5.4	0.0	9.8
757RR	Light Jet B	7.6	0.0	4.4	2.2	14.2
A319-131	Light Jet B	4.3	0.0	4.3	0.0	8.6
A320-232	Light Jet B	8.0	4.0	10.9	1.1	24.0
A321-232	Light Jet B	6.2	2.5	5.4	3.3	17.4
EMB190	Light Jet B	34.7	3.3	34.6	3.4	76.0
MD81	Light Jet B	5.4	1.1	3.3	3.3	13.1
MD83	Light Jet B	0.0	2.2	0.0	2.2	4.4
1900D	Non-jet	2.2	0.0	2.2	0.0	4.4
BEC58P	Non-jet	474.0	37.6	465.5	45.6	1,022.7
C130	Non-jet	1.1	0.0	1.1	0.0	2.2
CIT3	Non-jet	53.8	3.5	51.0	6.5	114.8
CNA172	Non-jet	40.1	0.0	40.1	0.0	80.2
CNA182	Non-jet	62.9	1.2	64.0	0.0	128.1
CNA206	Non-jet	76.0	2.2	78.0	1.2	157.4
CNA208	Non-jet	760.2	91.9	761.6	95.5	1,709.2
CNA20T	Non-jet	2.2	0.0	2.2	0.0	4.4
CNA441	Non-jet	269.0	14.6	265.7	20.6	569.9
DHC6	Non-jet	0.0	0.0	1.0	0.0	1.0
DHC8	Non-jet	3.3	0.0	3.3	0.0	6.6
DHC830	Non-jet	18.1	1.4	15.2	4.3	39.0
DO228	Non-jet	190.4	10.1	178.0	20.6	399.1
DO328	Non-jet	5.4	0.0	5.4	0.0	10.8
EMB120	Non-jet	2.2	0.0	1.1	1.1	4.4
GASEPF	Non-jet	4.3	0.0	4.3	0.0	8.6
GASEPV	Non-jet	335.2	25.0	341.8	18.4	720.4
PA28	Non-jet	20.6	1.1	20	1.7	43.4
PA30	Non-jet	4.3	0.0	4.3	0.0	8.6
PA31	Non-jet	36.8	1.1	31.0	3.9	72.8

Table H-1a 2013 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
PA42	Non-jet	2.2	0.0	2.2	0.0	4.4
SD330	Non-jet	82.9	11.5	85.7	8.7	188.8
SF340	Non-jet	0.0	1.1	0.0	1.1	2.2
CL600	RJ	986.1	86.8	963.2	104.6	2,140.7
CL601	RJ	941.7	84.7	931.0	94.4	2,051.8
CNA500	RJ	84.9	29.0	84.6	29.3	227.8
CNA510	RJ	65.1	9.8	68.4	6.5	149.8
CNA525C	RJ	323.3	17.4	324.6	15.8	681.1
CNA55B	RJ	289.7	39.1	284.1	44.4	657.3
CNA560E	RJ	540.4	43.4	546.0	37.4	1,167.2
CNA560U	RJ	36.9	2.2	37.0	2.6	78.7
CNA560XL	RJ	932.4	68.9	923.3	80.3	2,004.9
CNA680	RJ	491.0	47.1	508.9	29.3	1,076.3
CNA750	RJ	684.7	81.4	694.5	71.5	1,532.1
ECLIPSE500	RJ	22.8	4.3	24.7	2.5	54.3
EMB145	RJ	61.9	9.8	67.3	4.3	143.3
F-18	RJ	1.1	0.0	1.1	0.0	2.2
F10062 (sub for the FA50 and F900)	RJ	405.1	39.8	401.7	38.0	884.6
FAL20	RJ	2.2	0.0	2.2	0.0	4.4
GII	RJ	2.2	0.0	2.2	0.0	4.4
GIIB	RJ	49.9	3.3	49.1	3.8	106.1
GIV	RJ	621.0	66.7	609.8	78.1	1,375.6
GV	RJ	540.3	61.8	550.1	52.1	1,204.3
IA1125	RJ	105.0	12.2	113.9	3.3	234.4
LEAR25	RJ	2.2	0.0	3.2	0.0	5.4
LEAR35	RJ	1,445	146.5	1,431.0	153.0	3,175.5
MU3001	RJ	586.8	40.4	577.2	51.0	1,255.4
General Aviation Total		**11,813.2**	**1,123.2**	**11,757.3**	**1,168.8**	**25,862.5**
Grand Total		**155,356.8**	**25,313.0**	**160,211.5**	**20,458.4**	**361,339.7**

Source: HMMH, 2014.
Notes: BEC58P is the INM substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft.
Annual operations modeled in the 2013 Annual contour.
Some totals may not match due to rounding.

Table H-1b 2014 Annual Modeled Operations

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
Commercial Jet Operations						
747400	Heavy Jet A	1,222.8	8.7	858.7	372.8	2,463.0
7478	Heavy Jet A	1.5	0.0	0.0	1.5	3.0
A340-211	Heavy Jet A	700.7	3.5	347.7	356.5	1,408.4
A340-642	Heavy Jet A	398.3	1.2	206.7	192.8	799.0
A380-841	Heavy Jet A	1.0	0.0	1.0	0.0	2.0
767300	Heavy Jet B	356.0	242.9	330.5	268.5	1,197.9
767400	Heavy Jet B	203.2	1.0	201.2	3.0	408.4
767CF6	Heavy Jet B	12.8	13.5	13.1	13.2	52.6
767JT9	Heavy Jet B	165.4	79.1	1.1	243.4	489.0
777200	Heavy Jet B	775.4	87.6	726.2	136.8	1,726.0
7773ER	Heavy Jet B	308.1	0.0	10.5	297.5	616.1
7878R	Heavy Jet B	506.5	0.0	503.5	3.0	1,013.0
A300-622R	Heavy Jet B	184.9	480.7	317.8	347.8	1,331.2
A310-304	Heavy Jet B	265.6	6.8	34.1	238.3	544.8
A330-301	Heavy Jet B	1,441.0	9.7	1,173.5	277.2	2,901.4
A330-343	Heavy Jet B	646.4	0.8	468.5	178.7	1,294.4
DC1010	Heavy Jet B	255.6	171.0	137.3	289.3	853.2
DC1030	Heavy Jet B	71.6	62.8	50.1	84.3	268.8
MD11GE	Heavy Jet B	215.9	83.8	152.5	147.1	599.3
MD11PW	Heavy Jet B	124.5	60.4	93.4	91.5	369.8
717200	Light Jet A	2,501.1	457.9	2,608.2	350.9	5,918.1
727EM2	Light Jet A	5.0	0.0	1.0	4.0	10.0
MD9025	Light Jet A	885.6	73.0	878.6	80.0	1,917.2
MD9028	Light Jet A	449.7	41.4	455.2	35.9	982.2
737300	Light Jet B	1,607.1	166.4	1,625.3	148.1	3,546.9
7373B2	Light Jet B	109.6	12.0	106.6	14.9	243.1
737400	Light Jet B	59.6	25.4	63.2	21.8	170.0
737500	Light Jet B	6.0	1.0	7.0	0.0	14.0
737700	Light Jet B	6,031.8	2,492.7	7,070.5	1,453.9	17,048.9
737800	Light Jet B	13,590.9	5,544.2	16,369.7	2,765.4	38,270.2
737N17	Light Jet B	1.0	0.0	1.0	0.0	2.0
757300	Light Jet B	242.4	96.4	329.3	9.4	677.5
757PW	Light Jet B	2,832.9	571.6	3,007.0	397.5	6,809.0
757RR	Light Jet B	3,293.6	706.5	3,595.6	404.5	8,000.2
A319-131	Light Jet B	8,127.4	2,275.4	8,836.7	1,566.1	20,805.6

Note: Some totals may not match due to rounding.

Table H-1b 2014 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
Commercial Jet Operations (Continued)						
A320-211	Light Jet B	3,630.0	716.3	3,880.3	466.0	8,692.6
A320-232	Light Jet B	15,555.3	5,506.3	18,160.1	2,901.5	42,123.2
A321-232	Light Jet B	2,042.7	697.7	2,312.1	428.3	5,480.8
EMB190	Light Jet B	29,267.6	2,968.2	28,378.0	3,857.8	64,471.6
EMB195	Light Jet B	13.0	1.0	14.0	0.0	28.0
MD82	Light Jet B	9.0	0.0	6.0	3.0	18.0
MD83	Light Jet B	877.8	55.2	826.8	106.2	1,866.0
CL601	RJ	5,139.8	333.5	5,305.2	168.1	10,946.6
CRJ9-ER	RJ	3,488.7	284.7	3,341.8	431.6	7,546.8
CRJ9-LR	RJ	1,679.8	108.8	1,570.5	218.0	3,577.1
EMB145	RJ	60.0	1.0	55.0	6.0	122.0
EMB14L	RJ	1,946.7	64.3	1,797.7	213.3	4,022.0
EMB170	RJ	4,621.3	287.8	4,539.3	369.8	9,818.2
EMB175	RJ	3,945.9	125.7	3,860.7	210.9	8,143.2
LEAR35	RJ	20.7	6.3	21.8	5.2	54
Commercial Jets Subtotal		**119,899.2**	**24,934.2**	**124,651.6**	**20,181.3**	**289,666.3**
Commercial Non-Jet Operations						
BEC58P	Non-jet	17244.7	295.3	17413.6	126.4	35080
CNA182	Non-jet	2.0	0.0	2.0	0.0	4.0
CNA208	Non-jet	209.6	2.2	209.6	2.2	423.6
DHC8	Non-jet	1,518.7	12.9	1,519.2	12.5	3,063.3
DHC830	Non-jet	2,224.4	147.1	2,151.9	219.6	4,743.0
DO328	Non-jet	9.6	0.0	9.6	0.0	19.2
SF340	Non-jet	2,183.1	7.9	2,185.9	5.1	4,382.0
Commercial Non-Jet Operations Subtotal		**23,392.1**	**465.4**	**23,491.8**	**365.8**	**47,715.1**
Commercial Aircraft Total		**143,291.3**	**25,399.6**	**148,143.4**	**20,547.1**	**337,381.4**
General Aviation Operations						
74720B	Heavy Jet A	1.1	1.1	2.1	0.0	4.3
DC870	Heavy Jet A	7.5	0.0	7.5	0.0	15.0
767300	Heavy Jet B	1.1	1.1	2.1	0.0	4.3
7878R	Heavy Jet B	7.5	0.0	7.5	0.0	15.0
727EM1	Light Jet A	4.3	0.0	3.2	1.1	8.6
727EM2	Light Jet A	1.1	2.1	0.0	3.2	6.4
737400	Light Jet B	4.3	1.1	5.3	0.0	10.7
737700	Light Jet B	25.6	0.0	23.4	2.1	51.1
737800	Light Jet B	12.8	14.9	21.1	6.6	55.4
757PW	Light Jet B	3.2	1.1	4.3	0.0	8.6

Notes: BEC58P is the INM substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft.
Some totals may not match due to rounding.

Table H-1b 2014 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
General Aviation Operations (continued)						
757RR	Light Jet B	3.2	0.0	1.1	2.1	6.4
A319-131	Light Jet B	5.3	0.0	5.3	0.0	10.6
A320-211	Light Jet B	5.3	4.3	9.6	0.0	19.2
A320-232	Light Jet B	8.5	0.0	6.4	2.1	17.0
A321-232	Light Jet B	4.0	1.3	4.3	1.1	10.7
EMB190	Light Jet B	9.6	0.0	4.8	4.8	19.2
EMB195	Light Jet B	0.0	1.1	1.1	0.0	2.2
MD81	Light Jet B	3.2	2.1	3.2	2.1	10.6
MD83	Light Jet B	5.3	2.1	4.6	2.8	14.8
1900D	Non-jet	4.3	0.0	4.3	0.0	8.6
BEC58P	Non-jet	345.8	15.5	341.0	20.2	722.5
CNA172	Non-jet	58.4	4.5	61.8	1.1	125.8
CNA182	Non-jet	29.8	0.0	28.8	1.1	59.7
CNA206	Non-jet	77.8	1.1	77.8	1.1	157.8
CNA208	Non-jet	841.7	100.4	842.4	99.6	1,884.1
CNA20T	Non-jet	3.2	0.0	3.2	0.0	6.4
CNA441	Non-jet	305.7	12.9	291.5	27.2	637.3
DC3	Non-jet	1.1	0.0	0.0	1.1	2.2
DHC6	Non-jet	1.1	1.1	1.1	1.1	4.4
DHC830	Non-jet	3.2	0.0	3.2	0.0	6.4
DO228	Non-jet	343.7	25.1	330.4	38.4	737.6
EMB120	Non-jet	0.0	1.1	0.0	1.1	2.2
GASEPF	Non-jet	7.5	0.0	6.4	1.1	15.0
GASEPV	Non-jet	416.4	32.2	434.7	13.9	897.2
HS748A	Non-jet	1.1	0.0	1.1	0.0	2.2
PA28	Non-jet	25.6	0.0	25.6	0.0	51.2
PA30	Non-jet	4.3	0.0	4.3	0.0	8.6
PA31	Non-jet	39.2	1.3	37.3	3.2	81.0
PA42	Non-jet	3.2	1.1	2.8	1.4	8.5
SD330	Non-jet	42.6	1.1	40.3	3.3	87.3
CIT3	RJ	36.9	4.7	40.5	1.1	83.2
CL600	RJ	1,121.8	83.5	1,127.1	78.2	2,410.6
CL601	RJ	1,042.8	81.5	1,058.9	65.4	2,248.6
CNA500	RJ	75.7	17.1	71.5	21.2	185.5
CNA510	RJ	36.8	9.1	35.5	10.3	91.7
CNA525C	RJ	282.1	12.1	279.2	14.9	588.3
CNA55B	RJ	255.8	22.4	259.6	18.6	556.4
CNA560E	RJ	425.9	33.4	428.5	30.8	918.6

Note: Some totals may not match due to rounding.

Table H-1b 2014 Annual Modeled Operations (Continued)

INM Type	Runway Use Group	Arrivals Day	Arrivals Night	Departures Day	Departures Night	Total
General Aviation Operations (Continued)						
CNA560U	RJ	127.9	16.0	133.6	10.2	287.7
CNA560XL	RJ	921.3	64.5	923.9	61.8	1,971.5
CNA680	RJ	495.5	40.5	498.3	37.8	1,072.1
CNA750	RJ	563.7	62.9	591.7	34.9	1,253.2
CRJ9-ER	RJ	6.4	0.0	6.4	0.0	12.8
ECLIPSE500	RJ	29.8	2.1	30.9	1.1	63.9
EMB145	RJ	73.5	14.9	73.6	14.9	176.9
F10062	RJ	455.0	46.9	470.3	31.6	1,003.8
GIIB	RJ	23.4	2.2	24.5	1.1	51.2
GIV	RJ	692.4	69.6	700.0	61.9	1,523.9
GV	RJ	686.2	77.8	690.0	74.1	1,528.1
IA1125	RJ	124.7	11.7	126.7	9.7	272.8
LEAR25	RJ	4.3	0.0	4.3	0.0	8.6
LEAR35	RJ	1,422.5	159.0	1,426.5	155.0	3,163.0
MU3001	RJ	536.7	37.7	541.7	32.7	1,148.8
General Aviation Total		**12,109.7**	**1,099.3**	**12,198.1**	**1,010.2**	**26,417.3**
Grand Total		**155,401.00**	**26,498.9**	**160,341.5**	**21,557.3**	**363,798.7**

Source: HMMH, 2014.
Notes: BEC58P is the INM substitution for the Cessna 402.
The CRJ9-ER in the RJ category is the CRJ700 aircraft
Annual operations modeled in the 2014 Annual contour.
Some totals may not match due to rounding.

RJs are defined as those aircraft with 90 or less seats, consistent with the categorization in *Chapter 2, Activity Levels*.[13] For years prior to 2010, the RJs in this report were classified as aircraft with less than 100 seats. When RJs first started gaining popularity, the aircraft types available were typically 50 seats or less with the traditional air carrier jet being 100 seats and higher. As newer aircraft types have become available, the smaller 35 to 50 seat types have been replaced by 70 to 99-seat types, with the 90 and above seat types flying many of the traditional air carrier routes. The majority of the newer types fall into two categories: the 70 to 75-seat category, which remain categorized as RJs, and the 91- to 99-seat category, which are categorized as air carrier jets. The Embraer 190 falls into this category and is now in the Light Jet B group.

Table H-2a shows the runway use that was used to model the 2013 noise conditions. Table H-2b shows the runway used to model the 2014 noise conditions. As described above, turbojet aircraft in the table were grouped into different categories for reporting purposes. Because the 2013 and 2014 contour developed using RealContours™ reflects the individual use of the runways by each INM aircraft type, it accurately represents Logan Airport's noisiest aircraft by modeling them on the actual runways that they used during the year. The modeled runway use for each particular aircraft type may be different from the overall group runway use presented in Table H-2a for 2013 and Table H-2b for 2014.

13 U.S. Code, 2006 Edition, Supplement 3, Title 49 – Transportation Subtitle VII – Aviation Programs Part A – Air Commerce and Safety, Subpart II, Economic Regulation, Chapter 417 - Operations or Carriers, Subchapter III - Regional Air Service Incentive Program, Sec. 41762 – Definitions – defines RJ air carrier service to be aircraft with a maximum of 75 seats. Therefore, this report categorizes aircraft with 70-75 seats and below as RJ and aircraft with 90 seats and higher aircraft as air carrier (Note: there are no types with 75 to 90 seats).

Comparing Table H-2b (2014) with the similar Table H-2a (2013) in this *2014 EDR*, departure use of Runways 33L and 27 increased in almost all categories and decreased for Runways 22L, and 22R. For departures, the largest increases were a 13.1 percent increase for Light Jet A night departures on 27 and an 8.0 percent increase on 33L for Heavy Jet A day departures.

For arrivals, Runways 4L, and 27 show decreases in almost all aircraft categories between 2014 and 2013. Runways 4R, 15R, and 22L show increases in almost all aircraft categories.

The most significant change was to Runway 04R, which showed a 26.9 percent increase in 2014 for Light Jet A night arrivals. Runway 22L also showed notable increases for Heavy Jet A night time arrivals, which increased by 12.2 percent, and Light Jet B arrivals which increased by 10.3 percent

Table H-2a 2013 Modeled Runway Use by Aircraft Group

ARRIVALS

Runway	Heavy Jets - Group A		Heavy Jets - Group B		Light Jets - Group A		Light Jets - Group B		Regional Jets		Turboprops (Non-jets)	
	Day (%)	Night (%)	Day (%)	Night (%)	Day (%)	Night (%)	Day (%)	Night (%)	Day (%)	Night (%)	Day (%)	Night (%)
04L	0.34	0.00	0.39	0.00	5.83	1.13	4.91	0.64	12.39	3.16	24.57	6.83
04R	37.24	0.00	37.61	21.96	31.68	23.09	31.63	23.00	24.33	22.95	11.48	18.12
09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00
15R	1.09	0.00	1.37	1.30	1.10	0.33	1.16	0.52	1.02	0.70	0.84	0.45
22L	28.46	33.08	19.40	24.80	9.12	31.85	12.59	30.44	14.02	28.25	23.14	31.61
22R	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.03	0.00	2.52	1.67
27	17.25	5.26	27.42	9.31	39.44	20.97	36.78	16.46	32.33	17.62	17.87	15.05
32	0.00	0.00	0.00	0.00	0.49	0.00	0.42	0.01	3.15	0.00	6.92	0.60
33L	15.62	61.65	13.80	42.63	12.35	22.61	12.48	28.92	12.74	27.31	8.37	20.60
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.13	5.09
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

DEPARTURES

Runway	Heavy Jets - Group A		Heavy Jets - Group B		Light Jets - Group A		Light Jets - Group B		Regional Jets		Turboprops (Non-jets)	
	Day (%)	Night (%)	Day (%)	Night (%)	Day (%)	Night (%)	Day (%)	Night (%)	Day (%)	Night (%)	Day (%)	Night (%)
04L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	20.02	12.34
04R	17.36	7.93	13.79	3.89	3.68	0.48	5.21	3.17	1.78	2.63	5.46	3.28
09	12.62	2.39	17.41	18.25	33.75	22.66	30.60	21.21	35.81	23.11	12.97	7.70
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.04	0.20
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
15R	14.00	36.45	7.71	20.33	1.12	29.98	1.97	24.75	0.57	22.90	0.88	21.14
22L	12.29	11.01	8.20	1.42	0.46	0.48	2.27	1.22	0.19	0.15	0.90	1.32
22R	26.79	24.65	28.84	34.08	37.26	23.67	35.76	24.29	37.87	26.73	43.29	33.58
27	1.09	0.58	6.03	4.33	11.94	15.32	11.65	14.98	11.79	13.94	3.94	3.72
32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33L	15.85	16.98	18.01	17.70	11.80	7.41	12.54	10.38	11.97	10.47	12.38	16.72
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Massport, HMMH. 2013.
Notes: Night for noise modeling is defined as 10:00 PM to 7:00 AM.
Nighttime runway restrictions are from 11:00 PM to 6:00 AM.
Values may not add to 100 percent due to rounding.

Table H-2b 2014 Modeled Runway Use by Aircraft Group

ARRIVALS

Runway	Heavy Jets - Group A Day (%)	Heavy Jets - Group A Night (%)	Heavy Jets - Group B Day (%)	Heavy Jets - Group B Night (%)	Light Jets - Group A Day (%)	Light Jets - Group A Night (%)	Light Jets - Group B Day (%)	Light Jets - Group B Night (%)	Regional Jets Day (%)	Regional Jets Night (%)	Turboprops (Non-jets) Day (%)	Turboprops (Non-jets) Night (%)
04L	0.11	0.00	0.21	0.07	2.83	0.70	4.53	0.62	11.28	2.60	23.60	6.42
04R	40.88	26.86	41.56	24.41	32.38	24.16	32.33	22.47	25.78	25.15	13.56	25.24
09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00
15R	1.86	0.00	2.38	3.74	2.61	1.90	1.90	2.17	2.00	1.30	2.33	1.18
22L	28.13	45.31	23.90	26.43	17.89	32.24	22.86	34.61	22.27	34.95	25.98	34.13
22R	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.03	0.05	3.65	3.25
27	10.94	3.83	16.91	6.02	27.65	16.29	24.43	11.80	20.16	11.97	7.56	8.19
32	0.10	0.00	0.00	0.00	0.00	0.00	0.99	0.00	4.73	0.10	9.36	0.17
33L	17.98	24.01	15.04	39.33	16.63	24.72	12.94	28.33	13.75	23.89	10.32	19.15
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.26	2.28
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

DEPARTURES

Runway	Heavy Jets - Group A Day (%)	Heavy Jets - Group A Night (%)	Heavy Jets - Group B Day (%)	Heavy Jets - Group B Night (%)	Light Jets - Group A Day (%)	Light Jets - Group A Night (%)	Light Jets - Group B Day (%)	Light Jets - Group B Night (%)	Regional Jets Day (%)	Regional Jets Night (%)	Turboprops (Non-jets) Day (%)	Turboprops (Non-jets) Night (%)
04L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.67	14.30
04R	16.59	10.98	14.53	5.83	3.10	4.24	5.07	5.02	1.08	3.01	6.63	3.00
09	9.72	4.55	16.94	16.95	33.52	26.64	31.62	19.14	38.20	24.12	10.51	4.67
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00
15L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
15R	18.12	30.27	10.20	17.22	2.28	10.92	2.67	17.31	1.07	13.51	2.37	13.52
22L	8.65	5.36	7.35	1.83	0.26	0.45	1.86	1.48	0.12	0.19	1.00	1.25
22R	22.13	22.42	22.20	28.73	27.07	24.51	28.75	26.62	29.76	28.75	35.28	36.17
27	0.93	3.43	7.34	6.78	16.55	28.40	12.17	18.70	12.87	19.30	4.84	5.15
32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33L	23.86	22.99	21.45	22.65	17.21	4.83	17.87	11.72	16.89	11.13	16.59	21.94
33R	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Massport, HMMH. 2014.
Notes: Night for noise modeling is defined as 10:00 PM to 7:00 AM.
Nighttime runway restrictions are from 11:00 PM to 6:00 AM.
Values may not add to 100 percent due to rounding.

While Tables H-2a and H-2b present runway use by aircraft groups, Tables H-3a and H-3b present the total runway use (jets and non-jets) by runway and time of day. The first section of the table displays the operations by runway and time of day for an average day. The second section displays the same information for the year and the last section displays the percent that each runway is used by operation type and time of day.
Table H-3a shows that on an average day Runway 22R has the most departures (163.23 per day) and Runway 27 has the most arrivals (137.03 per day). At night, Runway 22R has the most departures (14.53 per night) but Runway 22L has the most arrivals (20.82 per night). Table H-3b shows that on an average day Runway 22R has the most departures (146.62 per day) and Runway 4R had the most arrivals (137.42 per day). At night, Runway 22R has the most departures (16.03 per night) but Runway 22L has the most arrivals (24.81 per night).

Table H-3a Summary of Jet and Non-Jet Aircraft Runway Use: 2013

	Runway												
	4L	4R	9	14[2]	15L	15R	22L	22R	27	32	33L	33R	Total
2013 Daily Operations													
Departures Day	14.70	21.53	123.79	0.03	0.05	7.81	8.13	163.23	44.49	0.00	55.14	0.03	438.93
Departures Night	0.21	1.76	11.48	0.01	0.00	13.64	0.69	14.53	7.36	0.00	6.36	0.00	56.04
Arrivals Day	40.78	114.92	0.00	0.00	0.11	4.61	63.83	1.89	137.03	8.77	50.72	2.99	425.65
Arrivals Night	0.75	15.77	0.00	0.00	0.00	0.40	20.82	0.05	11.26	0.02	20.14	0.14	69.35
Total Daily Operations	56.44	153.98	135.27	0.04	0.17	26.45	93.47	179.70	200.14	8.78	132.36	3.16	989.96
2013 Annual Operations													
Departures Day	5,367	7,860	45,182	12	19	2,850	2,969	59,578	16,238	0	20,125	12	160,212
Departures Night	77	644	4,192	2	0	4,978	252	5,304	2,687	0	2,322	0	20,458
Arrivals Day	14,884	41,946	0	0	42	1,681	23,296	690	50,015	3,200	18,512	1,090	155,356
Arrivals Night	272	5,755	0	0	0	145	7,600	20	4,112	7	7,352	50	25,313
Total Annual Operations	20,600	56,204	49,374	14	61	9,655	34,117	65,591	73,052	3,207	48,311	1,152	361,338
2013 Operations Percentage													
Percentage Departures Day	3%	5%	28%	<1%	<1%	2%	2%	37%	10%	<1%	13%	<1%	100%
Percentage Departures Night	<1%	3%	20%	<1%	<1%	24%	1%	26%	13%	<1%	11%	<1%	100%
Percentage Arrivals Day	10%	27%	<1%	<1%	<1%	1%	15%	<1%	32%	2%	12%	1%	100%
Percentage Arrivals Night	1%	23%	<1%	<1%	<1%	1%	30%	<1%	16%	<1%	29%	<1%	100%

Source: Massport Noise Office and HMMH 2013.

Table H-3b Summary of Jet and Non-Jet Aircraft Runway Use: 2014

	Runway												
	4L	4R	9	14[2]	15L	15R	22L	22R	27	32	33L	33R	Total
2014 Daily Operations													
Departures Day	16.17	21.43	126.91	0.06	0.01	11.63	6.84	130.59	48.27	0.00	77.37	0.02	439.30
Departures Night	0.23	3.00	10.97	0.00	0.00	10.15	0.90	16.03	9.75	0.00	8.03	0.00	59.06
Arrivals Day	37.34	120.81	0.11	0.00	0.17	8.63	99.03	2.66	86.79	12.95	54.95	2.32	425.76
Arrivals Night	0.65	16.61	0.00	0.00	0.00	1.56	24.81	0.06	8.37	0.01	20.48	0.04	72.59
Total Daily Operations	54.38	161.85	137.99	0.06	0.18	31.97	131.58	149.34	153.20	12.96	160.82	2.38	996.71
2014 Annual Operations													
Departures Day	5,901	7,820	46,322	21	3	4,244	2,498	47,667	17,620	0	28,239	6	160,341
Departures Night	83	1,095	4,005	0	0	3,705	327	5,852	3,560	0	2,930	0	21,557
Arrivals Day	13,630	44,096	40	0	63	3,149	36,146	970	31,680	4,727	20,055	846	155,402
Arrivals Night	236	6,064	0	0	0	569	9,056	23	3,057	3	7,475	16	26,499
Total Annual Operations	19,850	59,075	50,367	21	65	11,668	48,026	54,511	55,917	4,730	58,699	868	363,797
2014 Operations Percentage													
Percentage Departures Day	4%	5%	29%	<1%	<1%	3%	2%	30%	11%	<1%	18%	<1%	100%
Percentage Departures Night	<1%	5%	19%	<1%	<1%	17%	2%	27%	17%	<1%	14%	<1%	100%
Percentage Arrivals Day	9%	28%	<1%	<1%	<1%	2%	23%	1%	20%	3%	13%	1%	100%
Percentage Arrivals Night	1%	23%	<1%	<1%	<1%	2%	34%	<1%	12%	<1%	28%	<1%	100%

Source: Massport Noise Office and HMMH 2014.
Notes: The data reflect actual percentages of aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the Preferential Runway Advisory System (PRAS) to derive recommendations for use of a particular runway.
Runway 14-32 is unidirectional.
Values may not add to 100 percent due to rounding.

Runway use can also be presented in terms of percent of total operations as shown in Table H-4 for 2013 and 2014. Tables H-2a and H-2b total the runway use by aircraft group and time of day. Tables H-3a and H-3b total the runway use by operation type and time of day. Table H-4 presents the 2013 and 2014 Runway use for all operations which use Logan Airport.

In 2013, Runway 27 was the runway with the highest activity (primarily by jet arrivals), whereas in 2014, Runway 4R was the runway with the highest activity (primarily jet arrivals) with Runway 33L a very close second (primarily by jet departures).

Each year, non-jet activity makes up approximately 8.0 percent of the arrivals and 8.0 percent of the departures at Logan Airport.

Table H-4 Total 2013 and 2014 Modeled Runway Use by All Operations									
	Jet Arrivals		Non-Jet Arrivals		Jet Departures		Non-Jet Departures		All Operations
	Day	Night	Day	Night	Day	Night	Day	Night	
Runway	2013 Operations								Total
04L	2.3%	<0.1%	1.8%	<0.1%	<0.1%	<0.1%	1.5%	<0.1%	5.7%
04R	10.8%	1.5%	0.8%	<0.1%	1.8%	<0.1%	<0.1%	<0.1%	15.6%
9	0.0%	0.0%	0.0%	0.0%	11.5%	1.1%	1.0%	<0.1%	13.7%
14	0.0%	0.0%	0.0%	0.0%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
15L	0.0%	0.0%	<0.1%	0.0%	0.0%	0.0%	<0.1%	0.0%	<0.1%
15R	<0.1%	<0.1%	<0.1%	<0.1%	0.7%	1.3%	<0.1%	<0.1%	2.7%
22L	4.8%	2.0%	1.7%	<0.1%	0.8%	<0.1%	<0.1%	<0.1%	9.4%
22R	<0.1%	<0.1%	<0.1%	<0.1%	13.3%	1.4%	3.2%	<0.1%	18.2%
27	12.5%	1.1%	1.3%	<0.1%	4.2%	0.7%	<0.1%	<0.1%	20.2%
32	<0.1%	<0.1%	0.5%	<0.1%	0.0%	0.0%	0.0%	0.0%	0.9%
33L	4.5%	2.0%	0.6%	<0.1%	4.7%	0.6%	0.9%	<0.1%	13.4%
33R	0.0%	0.0%	<0.1%	<0.1%	0.0%	0.0%	<0.1%	0.0%	<0.1%
Total	**35.7%**	**6.7%**	**7.3%**	**<0.1%**	**36.9%**	**5.5%**	**7.4%**	**<0.1%**	**100.0%**
Runway	2014 Operations								Total
04L	2.1%	<0.1%	1.7%	<0.1%	0.0%	0.0%	1.6%	<0.1%	5.5%
04R	11.2%	1.6%	1.0%	<0.1%	1.7%	<0.1%	<0.1%	<0.1%	16.2%
9	0.0%	0.0%	<0.1%	0.0%	12.0%	1.1%	0.8%	<0.1%	13.8%
14	0.0%	0.0%	0.0%	0.0%	<0.1%	0.0%	<0.1%	0.0%	<0.1%
15L	0.0%	0.0%	<0.1%	0.0%	0.0%	0.0%	<0.1%	0.0%	<0.1%
15R	0.7%	<0.1%	<0.1%	<0.1%	1.0%	1.0%	<0.1%	<0.1%	3.2%
22L	8.1%	2.4%	1.9%	<0.1%	0.6%	<0.1%	<0.1%	<0.1%	13.2%
22R	<0.1%	<0.1%	<0.1%	<0.1%	10.6%	1.6%	2.5%	<0.1%	15.0%
27	8.2%	0.8%	0.5%	<0.1%	4.5%	1.0%	<0.1%	<0.1%	15.4%
32	0.6%	<0.1%	0.7%	<0.1%	0.0%	0.0%	0.0%	0.0%	1.3%
33L	4.8%	2.0%	0.7%	<0.1%	6.6%	0.8%	1.2%	<0.1%	16.1%
33R	0.0%	<0.1%	<0.1%	<0.1%	0.0%	0.0%	<0.1%	0.0%	<0.1%
Total	**35.6%**	**7.1%**	**7.1%**	**<0.1%**	**36.9%**	**5.8%**	**7.2%**	**<0.1%**	**100.0%**

Flight Tracks

RealContours™ converts each radar track to an INM model track and then models the scaled aircraft operation on that track. This method keeps the lateral and vertical dispersion of the aircraft types consistent with the radar data, and ensures that anomalies in the departure paths are captured in the RealContours™ system. Table H-5 lists the number of flight tracks used in the RealContours™ modeling system for 2013 and 2014. Flight tracks from April 2014 are displayed in Figures 6-3 through 6-9 in *Chapter 6, Noise Abatement.*

Table H-5 Total Count of Flight Tracks Modeled in RealContours™ (2013 and 2014)

	Runway											
	4L	4R	9	14	15L	15R	22L	22R	27	32	33L	33R
2013												
Departures	4,838	8,180	47,822	12	16	7,624	3,121	62,126	18,400	0	21,644	10
Arrivals	14,111	46,200	0	0	36	1,768	29,528	619	52,211	2,928	25,045	977
2014												
Departures	5,984	8,915	50,327	21	3	7,950	2,825	53,518	21,180	0	31,169	6
Arrivals	13,866	50,160	39	0	63	3,718	45,201	993	34,736	4,730	27,530	862

Source: HMMH, 2013/2014; Exelis NOMS data.

Flight Profiles

To enhance the results from RealContours™, Massport elected to use the companion RealProfiles™ software. By using the actual radar information along with the equations developed for the INM, RealProfiles™ develops an altitude profile for each aircraft operation. This profile is then modeled in the RealContours™ system. As a result, the modeled aircraft follows both the actual radar track on the ground and the actual radar altitude profile in the sky.

RealProfiles™ provides several advantages over the standard INM profile modeling. The standard INM modeling uses a "Stagelength" to identify an aircraft's departure weight and then models a standard departure profile for that Stagelength. Using RealProfiles™, the RealContours™ system selects a weight similar to the standard modeling but then develops a profile to allow the INM aircraft to follow the actual path flown for that route. For example, if aircraft departing from a particular runway are required to remain level at 3,000 feet for a certain distance, RealProfiles™ will develop a profile that remains level for that distance along the track. In contrast, the standard modeling would use the standard INM profile and would not model the level segment.

For 2013, RealProfiles™ was able to compute profiles based on the actual radar data for 98.8 percent of the available departure tracks and 88.3 percent of the available arrivals. For 2014, RealProfiles™ was able to compute profiles based on the actual radar data for 98.6 percent of the available departure tracks and 94.8 percent of the available arrivals. RealProfiles™ uses the INM supplied aircraft performance database to develop its unique profiles; however, for several aircraft in the INM database the aircraft performance data are not available. For those profiles, the INM database contains fixed profiles, which are not modified and are used as supplied with the INM data.

Fleet Mix

As in the past, operations by aircraft types have been summarized into several key categories: commercial (passenger and cargo) operations, Stage 2 or Stage 3 jet aircraft, and turboprop and propeller (non-jet) aircraft. In addition, the operations are split into daytime and nighttime periods, where nighttime hours are defined as 10:00 PM to 7:00 AM, consistent with the definition of DNL. Table H-6 summarizes the numbers of operations by categories of aircraft operating at Logan Airport from 1990 through 2014. General aviation (GA) operations were not included in the noise modeling prior to 1998 and commercial jet operations were not separated until 1999.

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft[1] – 1990 to 2014

(Data for the years 2000 to 2014 are shown on the subsequent pages)

		1990	1992	1993	1994	1995	1996	1997	1998	1999
Commercial Aircraft										
Stage 2 Jets[2]	Day	312.40	228.89	203.34	189.40	156.90	132.40	108.46	84.93	83.30
	Night	19.99	13.13	7.44	10.10	5.50	4.79	7.75	5.92	6.66
	Total	**332.39**	**242.02**	**210.78**	**199.50**	**162.40**	**137.19**	**116.21**	**90.85**	**89.96**
Stage 3 Jets (All)	Day	288.89	384.49	418.99	425.70	429.40	439.81	505.08	541.43	597.28
	Night	57.25	58.29	65.47	62.80	69.00	80.16	85.06	95.54	98.59
	Total	**346.14**	**442.78**	**484.46**	**488.50**	**498.40**	**519.97**	**590.14**	**636.97**	**695.87**
Air Carrier Jets	Day	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	569.18
	Night	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	96.21
	Total	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	**665.39**
Regional Jets	Day	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	28.10
	Night	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	2.38
	Total	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	NA[3]	**30.48**
Non-Jets	Day	444.41	411.84	598.16	541.97	526.85	505.31	514.70	552.56	448.82
	Night	11.72	69.32	46.84	13.59	11.14	13.73	27.27	21.86	16.63
	Total	**456.13**	**481.16**	**645.00**	**555.56**	**537.99**	**519.04**	**541.97**	**574.42**	**465.45**
Total Commercial Operations	Day	1045.70	1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1178.92	1129.90
	Night	88.96	140.74	119.75	86.49	85.64	98.68	120.08	123.32	121.88
	Total	**1134.66**	**1165.96**	**1340.24**	**1243.56**	**1198.79**	**1176.20**	**1248.32**	**1302.24**	**1251.78**
GA Aircraft										
Stage 2 Jets[2]	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	5.25	9.89
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	0.40	0.74
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	**5.65**	**10.63**
Stage 3 Jets	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	30.54	48.46
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	4.21	6.55
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	**34.75**	**55.01**
Non-Jets	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	37.29	19.36
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	16.28	18.89
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	**53.57**	**38.25**
Total GA Operations	Day	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	73.08	77.71
	Night	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	20.89	26.17
	Total	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	NA[4]	**93.97**	**103.88**
Total	Day	1045.70	1025.22	1220.49	1157.07	1113.15	1077.52	1128.24	1252.00	1207.61
	Night	88.96	140.74	119.75	86.49	85.64	98.68	120.08	144.21	148.05
	Total[3]	**1134.66**	**1165.96**	**1340.24**	**1243.56**	**1198.79**	**1176.20**	**1248.32**	**1396.21**	**1355.66**

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft[1] – 1990 to 2014 (Continued)

(Data for the years 1990 to 1999 are shown on the prior page)

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Commercial Aircraft											
Stage 2 Jets[2]	Day	5.13	1.18	0.05	0.08	0.03	0.05	0.03	0.03	0.01	0.00
	Night	0.26	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
	Total	**5.39**	**1.23**	**0.05**	**0.08**	**0.05**	**0.06**	**0.03**	**0.04**	**0.02**	**0.00**
Stage 3 Jets (All)	Day	727.09	756.24	740.75	717.85	772.39	765.76	767.55	748.13	699.39	668..32
	Night	103.66	109.77	97.04	92.69	113.24	113.66	114.81	118.29	114.30	103.11
	Total	**830.75**	**866.01**	**837.79**	**810.54**	**885.63**	**879.42**	**882.36**	**866.42**	**813.69**	**771.43**
Air Carrier Jets	Day	648.95	569.99	500.70	461.06	518.96	505.48	490.63	472.39	443.15	421.51
	Night	99.79	101.30	83.52	72.69	89.24	91.99	92.71	96.28	89.89	82.19
	Totals	**748.74**	**671.29**	**584.22**	**533.75**	**608.20**	**597.47**	**583.34**	**568.66**	**533.04**	**503.70**
Regional Jets	Day	78.14	186.25	240.05	256.80	253.43	260.34	276.95	275.77	256.24	246.81
	Night	3.87	8.47	13.52	19.99	24.00	21.68	22.11	22.03	24.40	20.93
	Total	**82.01**	**194.72**	**253.57**	**276.79**	**277.43**	**282.01**	**299.06**	**297.80**	**280.64**	**267.73**
Non-Jets	Day	409.62	317.62	165.45	135.18	133.24	148.77	140.81	145.27	132.52	136.45
	Night	21.58	10.97	3.45	2.41	3.03	3.02	3.26	3.47	4.00	5.54
	Total	**431.20**	**328.58**	**168.89**	**137.59**	**136.28**	**151.79**	**144.07**	**148.73**	**136.52**	**141.99**
Total Commercial Operations	Day	1141.84	1075.04	906.25	853.10	905.66	914.59	908.41	893.43	831.92	804.77
	Night	125.51	120.79	100.49	95.10	116.29	116.68	118.09	121.77	118.31	108.65
	Total	**1267.35**	**1195.82**	**1006.73**	**948.20**	**1021.95**	**1031.27**	**1026.51**	**1015.19**	**950.23**	**913.42**
GA Aircraft											
Stage 2 Jets[2]	Day	7.29	5.15	3.65	2.84	0.94	2.29	1.90	1.24	0.36	0.09
	Night	0.64	0.50	0.41	0.26	0.14	0.25	0.17	0.19	0.03	0.01
	Total	**7.93**	**5.65**	**4.08**	**3.10**	**1.08**	**2.54**	**2.07**	**1.43**	**0.38**	**0.10**
Stage 3 Jets	Day	40.08	34.23	37.83	46.21	53.72	58.84	61.08	54.82	43.98	22.31
	Night	3.21	3.28	6.42	6.98	8.37	9.33	6.57	6.39	4.52	2.28
	Total	**43.29**	**37.51**	**44.25**	**53.19**	**62.09**	**68.16**	**67.65**	**61.21**	**48.49**	**23.59**
Non-Jets	Day	34.57	37.31	17.36	17.81	16.95	14.00	15.05	11.98	15.13	8.19
	Night	1.83	1.92	4.45	4.40	5.20	4.75	1.39	3.61	1.08	0.74
	Total	**36.40**	**39.23**	**21.81**	**22.21**	**22.14**	**18.75**	**16.44**	**15.58**	**16.20**	**8.93**
Total GA Operations	Day	81.94	76.68	58.84	66.88	71.60	75.12	78.03	68.04	59.46	29.58
	Night	5.68	5.71	11.29	11.64	13.71	14.33	8.13	10.19	5.62	3.04
	Total	**87.62**	**82.39**	**70.13**	**78.52**	**85.31**	**89.46**	**86.15**	**78.22**	**65.05**	**32.62**
Total	Day	1223.78	1151.72	965.09	919.98	977.27	989.71	986.43	961.46	891.39	834.35
	Night	131.19	126.50	111.78	106.74	130.00	131.02	126.22	131.96	123.93	111.69
	Total[3]	**1354.97**	**1278.21**	**1076.86**	**1026.72**	**1107.26**	**1120.73**	**1112.66**	**1093.42**	**1015.31**	**946.04**

Table H-6 Modeled Daily Operations by Commercial and General Aviation (GA) Aircraft[1] – 1990 to 2014 (Continued)

(Data for the years 1990 to 2009 are shown on the prior pages)

		2010	2011	2012	2013	2014	Difference Between 2014 and 2013
Commercial Aircraft							
Stage 2 Jets[2]	Day	0.01	0.01	0.01	0.01	0.00	(0.01)
	Night	0.01	0.00	0.00	0.00	0.00	0.00
	Total	**0.02**	**0.01**	**0.01**	**0.01**	**0.00**	**(0.01)**
Stage 3 Jets (All)	Day	674.25	684.19	649.22	667.65	670.00	2.35
	Night	107.92	109.38	106.55	115.91	123.60	7.69
	Total	**782.17**	**793.57**	**755.77**	**783.56**	**793.61**	**10.04**
Air Carrier Jets	Day	521.64	571.03	530.76	546.27	556.59	10.32
	Night	93.98	99.17	98.68	107.17	115.84	8.66
	Total	**615.62**	**670.20**	**629.44**	**653.44**	**672.43**	**18.99**
Regional Jets	Day	152.61	113.16	118.46	121.38	113.41	(7.97)
	Night	13.94	10.21	7.87	8.74	7.77	(0.97)
	Total	**166.55**	**123.37**	**126.33**	**130.12**	**121.18**	**(8.95)**
Non-Jets	Day	138.53	135.18	133.92	132.33	128.45	(3.88)
	Night	5.21	4.73	3.06	3.21	2.28	(0.93)
	Total	**143.74**	**139.91**	**136.98**	**135.54**	**130.73**	**(4.81)**
Total Commercial Operations	Day	812.78	819.39	783.14	799.99	798.45	(1.54)
	Night	113.13	114.11	109.62	119.12	125.88	6.76
	Total	**925.91**	**933.50**	**892.76**	**919.12**	**924.33**	**5.22**
GA Aircraft							
Stage 2 Jets[2]	Day	0.27	0.08	0.25	0.31	0.00	(0.31)
	Night	0.04	0.00	0.04	0.02	0.00	(0.02)
	Total	**0.30**	**0.08**	**0.29**	**0.33**	**0.00**	**(0.33)**
Stage 3 Jets	Day	27.80	52.51	52.93	51.21	52.64	1.43
	Night	3.21	5.35	7.20	5.10	4.65	(0.45)
	Total	**31.01**	**57.87**	**60.13**	**56.31**	**57.29**	**0.98**
Non-Jets	Day	8.19	18.18	15.16	13.06	13.95	0.89
	Night	0.72	1.29	1.29	1.15	1.13	(0.03)
	Total	**8.92**	**19.48**	**16.45**	**14.22**	**15.08**	**0.87**
Total GA Operations	Day	70.78	68.35	64.58	66.59	70.78	2.02
	Night	6.65	8.52	6.28	5.78	6.65	-0.50
	Total	**77.43**	**76.86**	**70.85**	**72.37**	**77.43**	**1.52**
Total	Day	890.16	851.49	864.57	865.05	890.16	0.47
	Night	120.76	118.13	125.40	131.66	120.76	6.26
	Total[3]	**1010.92**	**969.61**	**989.97**	**996.70**	**1010.92**	**6.73**

Source: Massport's Noise Monitoring System and Revenue Office numbers, HMMH 2014.
Notes: Data from 1991 not available.
1 Includes scheduled and unscheduled operations.
2 Stage 2 aircraft are exempt from meeting newer federal Stage 3 noise limits when their maximum gross takeoff weight is less than or equal to 75,000 pounds.
3 RJ operations were not tracked separately prior to 1999.
4 Totals prior to 1998 do not include GA operations.
5 The definition of RJ for the EDR changed between 2009 and 2010. A RJ in 2010 is a jet in commercial service with less than 80 seats. Prior to 2010, a RJ was a jet in commercial service with 100 seats or less.

Commercial Jet Aircraft by Part 36 Stage Category

Jet aircraft currently operating at Logan Airport are categorized by the FAA into two groups: Stage 2 and Stage 3. As described in *Chapter 6, Noise Abatement*, the designation refers to a noise classification specified in Federal Aviation Regulation Part 36 that sets noise emission standards at three measurement locations – takeoff, landing, and sideline – based on an aircraft's maximum certificated weight. The heavier the aircraft, the more noise it is permitted to make within limits. Because of the substantial differences in noise between Stage 2, re-certificated Stage 3, and new Stage 3 aircraft, Massport tracks operations by these separate categories to follow their trends. Table H-7 shows the percentage of commercial jet operations by stage category from 1999 through 2014. One of the most significant changes occurring after the economic downturn in 2001 was the almost immediate retirement of the re-certificated aircraft from airlines' fleets due to their high operating costs. This type of accelerated retirement is not as prevalent during the 2008 to 2009 economic downturn since it is no longer the major airlines operating these aircraft. However, these aircraft still have high operating costs and are being replaced wherever possible.

Table H-7 Percentage of Commercial Jet Operations by Part 36 Stage Category – 1999 to 2014

	New Stage 3[1]	Recertificated Stage 3[2]	Stage 2	Total
1999	70.0%	21.0%	9.0%	100%
2000	75.0%	24.0%	1.0%	100%
2001	86.3%	13.6%	0.1%	100%
2002	92.8%	7.2%	0.0%	100%
2003	95.8%	4.1%	0.0%	100%
2004	97.8%	2.2%	0.0%	100%
2005	98.0%	2.0%	0.0%	100%
2006	98.6%	1.4%	0.0%	100%
2007	98.9%	1.1%	0.0%	100%
2008	99.1%	0.9%	0.0%	100%
2009	99.1%	0.9%	0.0%	100%
2010	98.9%	1.1%	0.0%	100%
2011	99.5%	0.5%	0.0%	100%
2012	99.9%	0.1%	0.0%	100%
2013	100.0%	<0.1%	<0.1%	100%
2014	100.0%	<0.1%	0.0%	100%

Source: Massport and FAA radar data.

Notes:

1 New Stage 3 aircraft are aircraft originally manufactured as a certified Stage 3 aircraft under Federal Regulation Part 36.

2 Recertificated Stage 3 aircraft are aircraft originally manufactured as a certified Stage 1 or 2 aircraft under Federal Regulation Part 36, which either have been treated with hushkits or have been re-engineered to meet Stage 3 requirements.

Nighttime Operations

Massport tracks flights that operate between the broader DNL nighttime periods of 10:00 PM to 7:00 AM, when each flight is penalized 10 dB in calculations of noise exposure. Table H-8 shows this nighttime activity by different groups of aircraft. Nighttime flights by commercial jet operators have decreased by 2.6 percent at Logan Airport in 2012 compared to 2011 then increased by 8.8 percent in 2013 compared to 2012 and by 6.6 percent in 2014 compared to 2013. In 2012, commercial non-jet operations decreased 35.3 percent and GA traffic went up 28.1 percent at night compared to 2011. In 2013, commercial non-jet operations increased by 4.9 percent and GA traffic went down 26.4 percent at night compared to 2012. In 2014, commercial non-jet operations increased by 29.0 percent and GA traffic went down 8.0 percent at night compared to 2013. Overall, nighttime operations at Logan Airport decreased by 2.2 percent in 2012, increased by 6.2 percent in 2013 and increased by 5.0 percent in 2014. The majority of nighttime operations (between 10:00 PM and 7:00 AM) occurred either before midnight or after 5:00 AM.

Table H-8 Modeled Nighttime Operations at Logan Airport – 1990 to 2014

	Commercial Jets	Commercial Non-Jets	General Aviation	Total
1990	77.24	11.72	NA	88.96
1991	NA	NA	NA	NA
1992	71.42	69.32	NA	140.74
1993	72.91	46.84	NA	119.75
1994	72.90	13.59	NA	86.49
1995	74.50	11.14	NA	85.64
1996	84.95	13.73	NA	98.68
1997	92.81	27.27	NA	120.08
1998	101.46	21.86	NA	123.32
1999	105.25	16.63	26.17	148.05
2000	103.92	21.58	5.68	131.19
2001	109.82	10.97	5.71	126.50
2002	97.04	3.45	11.29	111.78
2003	92.69	2.41	11.64	106.74
2004	113.26	3.03	13.71	130.00
2005	113.67	3.02	14.33	131.02
2006	114.81	3.26	8.13	126.22
2007	118.30	3.47	10.19	131.96
2008	114.31	4.00	5.62	123.93
2009	103.05	5.56	3.08	111.70
2010	107.93	5.21	3.97	117.10
2011	109.38	4.73	6.65	120.76
2012	106.55	3.06	8.52	118.13
2013	115.91	3.21	6.28	125.40
2014	123.60	2.28	5.78	131.66
Change (2013 to 2014)	**7.69**	**(0.93)**	**(0.50)**	**6.26**
Percent Change	**6.64%**	**(29.06%)**	**(7.99%)**	**4.99%**

Source: Massport, HMMH, 2014.
Note: NA = Not available.

Jet Runway Use

Table H-9 presents a summary of runway use by jets. Since 2009, the radar data have been analyzed with Massport's Exelis Noise and Operational Monitoring System (NOMS), data from 2001 through 2008 was compiled with Massport's PreFlight™ software. PreFlight™ was an analysis package used to compile fleet, day/night splits, and runway use information from radar data. Data prior to 2001 were derived from Massport's original noise monitoring system, supplemented with field records. Note that Logan Airport Noise Rules prevent arrivals to Runway 22R and departures from Runway 4L by jet aircraft.

Table H-9 Summary of Jet Aircraft Runway Use – 1990 to 2014

	Runway									
	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
1990										
Departures	0%[2]	3%	21%	NA	10%	2%	36%	20%	NA	7%
Arrivals	1%	25%	0%	NA	2%	14%	0%	28%	NA	29%
1992[2]										
Departures	0%	6%	31%	NA	7%	2%	38%	10%	NA	6%
Arrivals	1%	37%	0%	NA	3%	12%	0%	30%	NA	17%
1993										
Departures	0%	9%	33%	NA	7%	3%	40%	4%	NA	4%
Arrivals	2%	44%	0%	NA	1%	11%	0%	28%	NA	15%
1994										
Departures	0%	9%	33%	NA	4%	3%	32%	12%	NA	5%
Arrivals	3%	42%	0%	NA	1%	8%	0%	27%	NA	19%
1995										
Departures	0%	8%	36%	NA	5%	5%	29%	11%	NA	5%
Arrivals	3%	41%	0%	NA	2%	8%	0%	27%	NA	17%
1996										
Departures	0%	8%	32%	NA	5%	6%	33%	12%	NA	5%
Arrivals	2%	38%	0%	NA	2%	11%	0%	29%	NA	18%
1997										
Departures	0%	8%	30%	NA	5%	6%	31%	15%	NA	5%
Arrivals	2%	36%	0%	NA	2%	9%	0%	30%	NA	20%
1998										
Departures	0%	8%	35%	NA	6%	5%	28%	14%	NA	5%
Arrivals	2%	41%	0%	NA	2%	7%	0%	28%	NA	19%
1999										
Departures	0%	8%	31%	NA	5%	4%	30%	15%	NA	6%
Arrivals	3%	37%	0%	NA	2%	10%	0%	28%	NA	21%
2000										
Departures	0%	8%	35%	NA	4%	3%	30%	15%	NA	6%
Arrivals	4%	40%	0%	NA	1%	7%	0%	28%	NA	20%
2001										
Departures	0%	7%	34%	NA	4%	3%	35%	12%	NA	5%
Arrivals	5%	36%	0%	NA	1%	8%	0%	32%	NA	18%
2002										
Departures	0%	4%	31%	NA	6%	3%	35%	16%	NA	6%
Arrivals	6%	31%	0%	NA	1%	12%	0%	30%	NA	21%

Table H-9 Summary of Jet Aircraft Runway Use – 1990 to 2014 (Continued)

	Runway									
	4L	4R	9	14[1]	15R	22L	22R	27	32[1]	33L
2003										
Departures	0%	4%	33%	NA	7%	2%	34%	14%	NA	6%
Arrivals	7%	33%	0%	NA	1%	14%	0%	28%	NA	18%
2004										
Departures	0%	5%	34%	NA	10%	4%	24%	18%	NA	6%
Arrivals	6%	34%	0%	NA	1%	12%	0%	24%	NA	23%
2005										
Departures	0%	5%	36%	NA	7%	1%	31%	13%	NA	7%
Arrivals	8%	33%	0%	NA	1%	11%	0%	29%	NA	17%
2006										
Departures	0%	4%	33%	0%	3%	1%	40%	13%	-	6%
Arrivals	7%	29%	0%	-	1%	14%	0%	33%	0.2%	16%
2007										
Departures	0%	5%	31%	0%	4%	1%	33%	7%	-	19%
Arrivals	5%	31%	0%	-	1%	15%	0%	36%	2%	11%
2008										
Departures	0%	6%	33%	<1%	3%	<1%	36%	6%	-	16%
Arrivals	6%	30%	-	-	2%	17%	-	33%	2%	11%
2009										
Departures	0%	7%	32%[3]	0%	3%	2%	34%	6%[3]	-	16%
Arrivals	7%	31%	-	-	3%	17%	0%	30%[3]	1%	11%
2010										
Departures	0%	4%	28%	<1%	8%	2%	31%	10%	-	17%
Arrivals	5%	28%	-	-	1%	15%	0%	32%	1%	16%
2011										
Departures	0%	6%	36%	<1%	5%[4]	2%	36%	7%	-	7%[4]
Arrivals	7%	37%	-	-	<1%[4]	16%	0%	28%	1%	11%[4]
2012										
Departures	0%	6%	33%	<1%	5%[4]	3%	38%	6%	-	9%[4]
Arrivals	6%	34%	-	-	1%[4]	16%	0%	33%	<1%	9%[4]
2013										
Departures	<1%	5%	30%	<1%	5%	2%	35%	12%	--	12%
Arrivals	6%	29%	--	--	1%	16%	<1%	32%	1%	15%
2014										
Departures	0%	5%	31%	<1%	5%	2%	28%	13%	-	17%
Arrivals	5%	30%	0%	-	2%	25%	<1%	21%	1%	16%

Source: HMMH 2014, Massport Noise Office.

Notes: The data reflect actual percentages of jet aircraft operations on each runway end. They should not be confused with effective runway use, which is used by the PRAS to derive recommendations for use of a particular runway. Effective runway percentages include a factor of 10 applied to nighttime operations so that use of a runway at night more closely reflects its effect on total noise exposure.
Jet aircraft are not able to use Runway 15L or 33R due to its length of only 2,557 feet.
Values may not add to 100 percent due to rounding. NA = Not available.

1 Runway 14-32 opened in late November 2006. (Runway 14-32 is unidirectional with no arrivals to Runway 14 and no departures from Runway 32).

2 The *1990 Final Generic Environmental Impact Report* was published and submitted to the Secretary of Environmental Affairs in July 1993. It included modeled operations and resulting noise contours for 1987, 1990, and a 1996-forecast year. The *1993 Annual Update* published in July 1994 included operations and contours for 1992 and 1993. 1991 data are not available.

3 Runway 9-27 had extended weekend closings for resurfacing during 2009.

4 Runway 15R-33L was closed for 3 months in 2011 and in 2012.

Annual Model Results and Status of Mitigation Programs

Noise Exposed Population

Table H-10 presents the noise-exposed population by community through 2014. This table includes population within the DNL 60 to 65 dB contours, although a DNL of 65 dB is the federally-defined noise criterion used as a guideline to identify when residential land use is considered incompatible with aircraft noise.

Table H-10 Noise-Exposed Population by Community

Year	Census Data	80+ dB DNL	75+ dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
BOSTON[2]							
1990	1980	0	0	1,778	28,970	30,748	NA
1992	1980	0	0	800	4,316	5,116	NA
1993	1980	0	0	264	2,820	3,084	NA
1994	1990	0	106	265	7,698	8,069	30,895
1995	1990	0	106	851	8,815	9,772	33,765
1996	1990	0	106	374	8,775	9,255	40,992
1997	1990	0	106	719	13,857	14,682	54,804
1998	1990	0	58	580	10,877	11,515	52,201
1999[3]	1990	0	58	364	11,632	12,054	45,948
2000[3]	1990	0	58	183	7,880	8,121	32,474
2000[3]	2000	0	0	234	9,014	9,248	35,785
2001[3]	2000	0	0	315	6,515	6,700	27,778
2002[3]	2000	0	0	132	2,625	2,757	23,225
2003[3]	2000	0	0	164	1,730	1,894	21,763
2004[3,4]	2000	0	65	192	4,142	4,399	24,473
2005[3,4]	2000	0	65	104	2,020	2,189	17,661
2006[4]	2000	0	65	99	1,054	1,218	14,866
2007 (INMv7.0a)[4]	**2000**	**0**	**0**	**169**	**4,094**	**4,263**	**21,446**
2008 (INMv7.0b)[4]	**2000**	**0**	**5**	**0**	**3,487**	**3,492**	**18,890**
2009 (INMv7.0b)[4]	**2000**	**0**	**5**	**67**	**937**	**1,009**	**12,284**
2010 (INMv7.0b)[4]	**2000**	**0**	**0**	**67**	**644**	**711**	**14,900**
2010 (INMv7.0b)[4]	**2010**	**0**	**0**	**0**	**689**	**689**	**17,646**
2011 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**331**	**331**	**11,600**
2012 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**439**	**439**	**12,076**
2012 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**421**	**421**	**11,037**
2013 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**612**	**612**	**14,835**
2014 (INMv7.0d)[4]	**2010**	**0**	**0**	**34**	**4,151**	**4,185**	**23,343**
CHELSEA							
1990	1980	0	0	0	4,813	4,813	NA
1992	1980	0	0	0	3,952	3,952	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	8,510
1995	1990	0	0	0	95	95	9,750
1996	1990	0	0	0	0	0	8,744
1997	1990	0	0	0	0	0	10,001
1998	1990	0	0	0	0	0	9,222
1999	1990	0	0	0	95	95	9,249
2000	1990	0	0	0	0	0	5,622
2000	2000	0	0	0	0	0	7,361
2001	2000	0	0	0	0	0	4,508
2002	2000	0	0	0	0	0	3,995
2003	2000	0	0	0	0	0	3,591
2004[4]	2000	0	0	0	0	0	7,756

Table H-10 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
CHELSEA							
2005[4]	2000	0	0	0	0	0	5,772
2006[4]	2000	0	0	0	0	0	2,477
2007 (INMv7.0a)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**9,774**
2008 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**7,793**
2009 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**5,462**
2010 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**4,880**
2010 (INMv7.0b)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**4,897**
2011 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2012 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2012 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2013 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**3,485**
2014 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**9,236**
EVERETT							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999[3]	1990	0	0	0	0	0	0
2000[3]	1990	0	0	0	0	0	0
2000[3]	2000	0	0	0	0	0	0
2001[3]	2000	0	0	0	0	0	0
2002[3]	2000	0	0	0	0	0	0
2003[3]	2000	0	0	0	0	0	0
2004[3,4]	2000	0	0	0	0	0	0
2005[3,4]	2000	0	0	0	0	0	0
2006[4]	2000	0	0	0	0	0	0
2007 (INMv7.0a)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2008 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2009 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2010 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2010 (INMv7.0b)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2011 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2012 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2012 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2013 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2014 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**

Table H-10	Noise-Exposed Population by Community (Continued)						
Year	**Census Data**	**80+ dB DNL**	**75-80 dB**	**70-75 dB DNL**	**65-70 dB**	**Total (65+)**	**60-65 dB DNL**
MEDFORD							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999	1990	0	0	0	0	0	0
2000	1990	0	0	0	0	0	0
2000	2000	0	0	0	0	0	0
2001	2000	0	0	0	0	0	0
2002	2000	0	0	0	0	0	0
2003	2000	0	0	0	0	0	0
2004[4]	2000	0	0	0	0	0	0
2005[4]	2000	0	0	0	0	0	0
2006[4]	2000	0	0	0	0	0	0
2007 (INMv7.0a)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2008 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2009 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2010 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2010 (INMv7.0b)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2011 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2012 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2012 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2013 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2014 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
QUINCY							
1990	1980	0	0	0	0	0	NA
1992	1980	0	0	0	0	0	NA
1993	1980	0	0	0	0	0	NA
1994	1990	0	0	0	0	0	0
1995	1990	0	0	0	0	0	0
1996	1990	0	0	0	0	0	0
1997	1990	0	0	0	0	0	0
1998	1990	0	0	0	0	0	0
1999	1990	0	0	0	0	0	0
2000	1990	0	0	0	0	0	0
2000	2000	0	0	0	0	0	636
2001	2000	0	0	0	0	0	610
2002	2000	0	0	0	0	0	610
2003	2000	0	0	0	0	0	610
2004[4]	2000	0	0	0	0	0	610
2005[4]	2000	0	0	0	0	0	610
2006[4]	2000	0	0	0	0	0	610
2007 (INMv7.0a)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2008 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2009 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2010 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**0**	**0**	**0**
2010 (INMv7.0b)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2011 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2012 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2012 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**

Table H-10 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB	Total (65+)	60-65 dB DNL
QUINCY							
2013 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
2014 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**0**	**0**	**0**
REVERE							
1990	1980	0	0	0	4,274	4,274	NA
1992	1980	0	0	0	3,848	3,848	NA
1993	1980	0	0	0	4,617	4,617	NA
1994	1990	0	0	0	3,569	3,569	2,099
1995	1990	0	0	0	3,364	3,364	2,304
1996	1990	0	0	172	3,292	3,464	2,505
1997	1990	0	0	0	3,293	3,293	2,047
1998	1990	0	0	0	3,168	3,168	2,132
1999	1990	0	0	128	3,165	3,293	2,047
2000	1990	0	0	0	2,552	2,552	2,386
2000	2000	0	0	0	2,496	2,496	3,100
2001	2000	0	0	0	2,496	2,496	3,100
2002	2000	0	0	0	2,822	2,822	2,399
2003	2000	0	0	0	2,994	2,994	2,227
2004[4]	2000	0	0	82	2,969	3,051	2,678
2005[4]	2000	0	0	82	2,540	2,622	2,731
2006[4]	2000	0	0	82	2,540	2,622	2,698
2007 (INMv7.0a)[4]	**2000**	**0**	**0**	**0**	**2,450**	**2,450**	**2,853**
2008 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**2,434**	**2,434**	**1,802**
2009 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**2,512**	**2,512**	**1,452**
2010 (INMv7.0b)[4]	**2000**	**0**	**0**	**0**	**2,505**	**2,505**	**1,385**
2010 (INMv7.0b)[4]	**2010**	**0**	**0**	**0**	**2,413**	**2,413**	**2,473**
2011 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**2,547**	**2,547**	**3,123**
2012 (INMv7.0c)[4]	**2010**	**0**	**0**	**0**	**2,772**	**2,772**	**3,236**
2012 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**2,762**	**2,762**	**3,191**
2013 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**2,505**	**2,505**	**2,791**
2014 (INMv7.0d)[4]	**2010**	**0**	**0**	**0**	**2,832**	**2,832**	**3,829**
WINTHROP							
1990	1980	0	676	1,211	2,420	4,307	NA
1992	1980	0	626	1,146	2,488	4,262	NA
1993	1980	0	648	1,211	1,773	3,632	NA
1994	1990	0	417	1,343	5,154	6,914	7,512
1995	1990	0	482	1,611	5,757	7,850	7,077
1996	1990	0	417	1,376	5,930	7,723	7,333
1997	1990	0	417	1,659	6,386	8,462	6,839
1998	1990	0	519	1,522	6,572	8,613	6,507
1999	1990	0	353	1,408	5,946	7,707	7,135
2000	1990	0	277	991	5,240	6,508	7,296
2000	2000	0	247	1,070	4,684	6,001	7,776
2001	2000	0	244	683	4,123	5,050	8,104
2002	2000	0	2	481	2,247	2,730	7,921
2003	2000	0	0	339	1,956	2,295	7,386
2004[4]	2000	0	2	337	1,649	1,988	6,508
2005[4]	2000	0	39	347	1,280	1,666	6,353
2006[4]	2000	0	39	416	1,288	1,743	6,845
2007 (INMv7.0a)[4]	**2000**	**0**	**0**	**247**	**1,139**	**1,386**	**6,749**
2008 (INMv7.0b)[4]	**2000**	**0**	**0**	**244**	**1,409**	**1,653**	**6,547**
2009 (INMv7.0b)[4]	**2000**	**0**	**0**	**171**	**643**	**814**	**4,221**
2010 (INMv7.0b)[4]	**2000**	**0**	**0**	**131**	**523**	**654**	**3,960**

Table H-10 Noise-Exposed Population by Community (Continued)

Year	Census Data	80+ dB DNL	75-80 dB DNL	70-75 dB DNL	65-70 dB DNL[1]	Total (65+)	60-65 dB DNL
WINTHROP							
2010 (INMv7.0b)[4]	**2010**	**0**	**0**	**130**	**598**	**728**	**3,720**
2011 (INMv7.0c)[4]	**2010**	**0**	**0**	**130**	**939**	**1069**	**4,303**
2012 (INMv7.0c)[4]	**2010**	**0**	**0**	**200**	**1,325**	**1,525**	**5,564**
2012 (INMv7.0d)[4]	**2010**	**0**	**0**	**200**	**1,186**	**1,386**	**5,305**
2013 (INMv7.0d)[4]	**2010**	**0**	**0**	**130**	**1,060**	**1,190**	**5,466**
2014 (INMv7.0d)[4]	**2010**	**0**	**0**	**130**	**1,775**	**1,905**	**6,456**
All Communities							
1990	1980	0	676	2,989	40,477	44,142	NA
1992	1980	0	628	2,352	14,604	17,584	NA
1993	1980	0	648	1,475	9,210	11,333	NA
1994	1990	0	523	1,608	16,421	18,552	49,016
1995	1990	0	588	2,462	18,031	21,081	52,896
1996	1990	0	523	1,922	17,997	20,442	59,574
1997	1990	0	523	2,378	23,536	26,437	73,691
1998	1990	0	577	2,102	20,617	23,296	70,062
1999	1990	0	411	1,900	20,838	23,149	64,379
2000	1990	0	335	1,174	15,672	17,181	47,778
2000	2000	0	247	1,304	16,194	17,745	54,190
2001	2000	0	244	998	13,004	14,246	43,616
2002	2000	0	2	613	7,694	8,309	38,150
2003	2000	0	0	503	6,680	7,183	35,577
2004[4]	2000	0	67	611	8,760	9,438	41,975
2005[4]	2000	0	104	533	5,840	6,477	33,127
2006[4]	2000	0	104	597	4,882	5,583	27,496
2007(INMv7.01)[4]	**2000**	**0**	**0**	**416**	**7,683**	**8,099**	**40,822**
2008(INMv7.0b)[4]	**2000**	**0**	**5**	**244**	**7,330**	**7,579**	**35,122**
2009 (INMv7.0b)[4]	**2000**	**0**	**5**	**238**	**4,092**	**4,335**	**23,419**
2010 (INMv7.0b)[4]	**2000**	**0**	**0**	**198**	**3,672**	**3,870**	**25,125**
2010 (INMv7.0b)[4]	**2010**	**0**	**0**	**130**	**3,700**	**3,830**	**28,736**
2011 (INMv7.0c)[4]	**2010**	**0**	**0**	**130**	**3,817**	**3,947**	**19,026**
2012 (INMv7.0c)[4]	**2010**	**0**	**0**	**200**	**4,536**	**4,736**	**20,876**
2012(INMv7.0d)[4]	**2010**	**0**	**0**	**200**	**4,369**	**4,569**	**19,533**
2013(INMv7.0d)[4]	**2010**	**0**	**0**	**130**	**4,177**	**4,307**	**26,577**
2014(INMv7.0d)[4]	**2010**	**0**	**0**	**164**	**8,758**	**8,922**	**42,864**

Source: Data prepared for Massport by HMMH 2014.
Notes: South End is included in Boston totals.
NA = Not available.
1 65 dB DNL is the federally-defined noise criterion.
2 Portions of Dorchester, East Boston, Roxbury, South Boston
3 Boston population by community changed in 1999 due to employment of more accurate hill effects methodology and reporting change.
4 All results since 2004 are from the RealContoursTM modeling system.

Residential Sound Insulation Program (RSIP)

In 2014, Massport completed sound insulation of 48 residential buildings containing 106 dwelling units, resulting in 5,467 residential buildings and 11,515 dwelling units that have been sound insulated since 1986 when the program was first implemented. Table H-11 lists the yearly progress of this mitigation effort.

Following the FAA's approval of model adjustments based on the effects of terrain (discussed in the *1999 ESPR*), Massport submitted, and the New England Region of the FAA approved, a new sound insulation program. The revised contour, approved for a two-year period beginning in 1999, included dwelling units in East Boston, South Boston, and Winthrop that previously had not been eligible for insulation. Massport

received notice of FAA funding for $5 million. Subsequently, Massport updated its program contour, first with the *2001 EDR* contour and more recently with the Logan Airside Improvements Project approved contour. These updates have allowed Massport to continue the program with additional funds every year since 1999. This latest update takes into account runway use changes due to the new Runway 14-32 which opened in late November 2006. This update expands the focus of the sound insulation program into Chelsea to satisfy the mitigation commitments made in the Airside Improvements Program Record of Decision (ROD). Massport has also utilized a program where they have contacted properties that are still eligible within the RSIP boundaries that had previously declined to participate. They have been offered a second chance to participate in the program.

Table H-11 Residential Sound Insulation Program (RSIP) Status (1986-2014)

Construction Year	Residential Buildings[1]	Dwelling Units[2]
1986	4	8
1987	43	51
1988	102	159
1989	94	133
1990	121	200
1991	175	360
1992	197	354
1993	318	654
1994	310	542
1995	372	753
1996	323	577
1997	364	808
1998	328	806
1999	330	718
2000	195	601
2001	260	278
2002	205	354
2003	230	468
2004	320	791
2005	314	471
2006	286	827
2007	160	548
2008	94	388
2009	111	287
2010	56	83
2011	62	114
2012[3]	0	0
2013	45	76
2014	48	106
Total	**5,467**	**11,515**

Source: Massport, 2014.
Notes:
1 Includes multiple units.
2 Individual units.
3 Federal funding was delayed in 2012

Table H-12 provides a list of all schools that have been treated under Massport's sound insulation program. To date, Massport has provided sound insulation to 36 schools at a cost of over $8 million.

Table H-12 Schools Treated Under Massport Sound Insulation Program

Boston:					
East Boston			**Winthrop**		
East Boston High		$381,948	Winthrop Jr. High School		$63,756
St. Mary's Star of the Sea		$80,901	E. B. Newton		$184,674
St. Dominic Savio High		$127,879	A. T. Cummings (Ctr.) School		$800,000
St. Lazarus		$46,092	**3**	**Total Winthrop Schools**	**$1,048,430**
James Otis		$46,092			
Samuel Adams		$120,650			
Curtis Guild		$180,572	**Revere**		
Dante Alighieri		$97,750	Beachmont School		$854,864
P.J. Kennedy		$127,637	**1**	**Total Revere School**	**$854,864**
Donald McKay		$231,754			
Hugh Roe O'Donnell		$113,564	**Chelsea**		
E Boston Central Catholic		$391,768	Shurtleff School		$292,207
Manassah Bradley		$237,500	Williams School		$486,258
13	**East Boston Schools**	**$2,184,107**	St. Rose Elementary		$46,396
			St. Stanislaus		$66,298
South Boston:			Chelsea High School		$524,249
St. Augustine		$92,855	**5**	**Total Chelsea Schools**	**$1,415,408**
Cardinal Cushing		$47,276			
Patrick Gavin		$217,077	**36**	**Total Schools**	**$8,159,020**
St. Bridgid's		$112,100			
Oliver Hazard Perry		$337,538			
Condon School		$294,481			
6	**South Boston Schools**	**$1,101,327**			
Roxbury and Dorchester:					
Samuel Mason		$192,401			
Dearborn Middle		$248,238			
Ralph Waldo Emerson		$155,851			
Lewis Middle		$202,092			
Nathan Hale Elem.		$92,302			
Phillis Wheatley Elem.		$290,794			
Davis Ellis Elem.		$253,663			
Henry L. Higginson		$119,543			
8	**Roxbury and Dorchester Schools**	**$1,554,884**			
27	**Total Boston Schools**	**$4,840,318**			

Source: Massport, 2014.

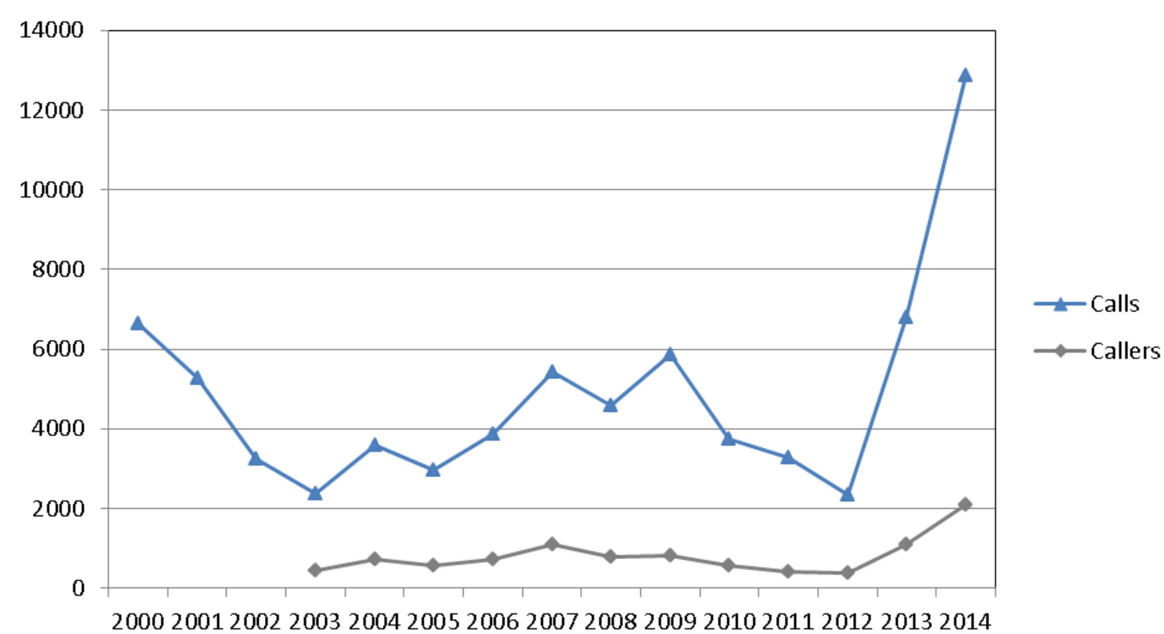
Noise Complaints

Table H-13 presents a detailed list by community of the total complaints made in 2013 and 2014, which can be filed either on Massport's Noise Complaint Line, through a form on Massport's website or through the PublicVue flight track portal. The Noise Complaint Line provides individuals the ability to express their concerns about aviation noise (activities) or to ask questions regarding noise at Logan Airport. Callers ask a range of questions such as "Why is this runway in use?"; "What times do the planes stop flying?" and "Was that aircraft off-course?"

The Noise Abatement Office (NAO) staff documents noise line complaints by obtaining information from the caller about the nature of the complaint, time of the occurrence, location of caller's residence, and the activity that was disturbed. The NAO uses the collected information to determine the probable activity responsible for the complaint and writes a letter report to the complainant. The letter includes the original complaint, a response that identifies the activity responsible for the call (arrivals, departures, run-up, etc.), meteorological information at the time of the call (a major factor in aviation activities), runways in use at the time of the call, and a notice that the FAA will receive a copy of the report.

In 2014, Massport received 12,855 noise complaints from 82 communities (Figure H-13) an increase of 88.8 percent. This large rise in complaints is due to the elimination of the head-to-head procedure at night and FAA changes that increased arrivals to Runway 22L. In addition the continued use of RNAV procedures have caused complaints. The RNAV procedure provides precise routing of departures so that they follow a very narrow path thus concentrating the flight track corridor. As a result, communities under these flight paths such as Belmont, Watertown, Cambridge, and Milton had significant increases in noise complaints in 2014. Higher use of Runway 33L and 15R in 2014 resulted in increased complaints from communities to the west of Logan Airport such as East Boston, Chelsea, Medford and Everett.

Figure H-13 Number of Callers and Complaints between 2000 and 2014



Source: Massport, HMMH 2014.
Notes: Number of callers is not available before 2003.

Massport's website, (www.massport.com/environment/environmental-reporting/noise-abatement/noise-complaints/), provides for additional general questions and answers regarding the Noise Complaint Line.

Table H-13 Noise Complaint Line Summary

Town	2013		2014		
	Calls	Callers	Calls	Callers	Change In Calls from 2013 to 2014
Allston	3	2	0	0	**-3**
Arlington	6	6	332	106	**326**
Athol	0	0	1	1	**1**
Auburn	1	1	0	0	**-1**
Belmont	605	65	1,658	116	**1,053**
Beverly	2	2	2	2	**0**
Billerica	2	2	0	0	**-2**
Boston	103	45	136	17	**33**
Braintree	6	3	2	2	**-4**
Brighton	1	1	1	1	**0**
Brockton	0	0	1	1	**1**
Brookline	3	2	3	2	**0**
Burlington	0	0	3	2	**3**
Cambridge	266	33	585	71	**319**
Canton	42	7	21	4	**-21**
Charlestown	9	8	5	3	**-4**
Chelsea	8	6	66	36	**58**
Cohasset	34	7	46	14	**12**
Dartmouth	0	0	1	1	**1**
Dedham	19	11	24	5	**5**
Dorchester	15	11	38	17	**23**
Durham	1	1	0	0	**-1**
Duxbury	2	1	1	1	**-1**
East Boston	124	42	354	106	**230**
Essex	0	0	27	1	**27**
Everett	50	15	270	54	**220**
Framingham	3	2	25	2	**22**
Gloucester	0	0	5	1	**5**
Hanover	10	3	1	1	**-9**
Harvard	0	0	1	1	**1**
Hingham	42	10	86	17	**44**
Holbrook	2	1	13	2	**11**
Hull	923	156	1,855	332	**932**

Table H-13 Noise Complaint Line Summary (Continued)

Town	2013 Calls	2013 Callers	2014 Calls	2014 Callers	Change In Calls from 2013 to 2014
Hyde Park	189	6	50	16	**-139**
Jamaica Plain	169	34	268	89	**99**
Kingston	1	1	1	1	**0**
Lawrence	1	1	0	0	**-1**
Leominster	0	0	2	2	**2**
Lexington	1	1	1	1	**0**
Lunenberg	0	0	3	2	**3**
Lynn	405	5	482	5	**77**
Lynnfield	0	0	2	1	**2**
Malden	1	1	8	5	**7**
Manchester	1	1	2	2	**1**
Marblehead	62	2	61	3	**-1**
Marshfield	7	2	7	6	**0**
Mattapan	0	0	1	1	**1**
Medford	49	33	742	154	**693**
Medway	0	0	1	1	**1**
Melrose	1	1	1	1	**0**
Middleton	0	0	3	2	**3**
Milton	1,925	222	2,669	189	**744**
Nahant	17	9	109	20	**92**
Natick	0	0	3	2	**3**
Newton	4	2	12	6	**8**
Norfolk	1	1	0	0	**-1**
North Andover	2	1	0	0	**-2**
Norwell	5	2	3	2	**-2**
Norwood	2	1	0	0	**-2**
Peabody	9	6	30	11	**21**
Quincy	22	14	27	17	**5**
Randolph	20	7	6	2	**-14**
Reading	3	3	2	2	**-1**
Revere	45	20	86	29	**41**
Rockland	1	1	0	0	**-1**
Roslindale	48	13	127	27	**79**
Roxbury	74	5	113	9	**39**
Ruxbury	0	0	2	2	**2**
Salem	2	2	20	13	**18**
Saugus	2	2	0	0	**-2**

Source: Massport, HMMH 2014.

Table H-13 Noise Complaint Line Summary (Continued)

Town	2013		2014		Change In Calls from 2013 to 2014
	Calls	Callers	Calls	Callers	
Scituate	1	1	4	4	**3**
Sherborn	1	1	0	0	**-1**
Shirley	0	0	6	2	**6**
Somerset	1	1	0	0	**-1**
Somerville	166	72	938	239	**772**
South Boston	438	22	67	26	**-371**
South Easton	0	0	1	1	**1**
South End	160	15	272	35	**112**
South Hamilton	0	0	2	1	**2**
Stoughton	1	1	1	1	**0**
Swampscott	1	1	5	3	**4**
Tewksbury	1	1	0	0	**-1**
Wakefield	1	1	1	1	**0**
Walpole	2	2	0	0	**-2**
Waltham	3	1	5	3	**2**
Watertown	196	44	541	72	**345**
Wellesley	0	0	1	1	**1**
Wenham	0	0	3	2	**3**
West Roxbury	8	5	24	9	**16**
Weston	0	0	1	1	**1**
Weymouth	217	7	83	7	**-134**
Wilmington	0	0	1	1	**1**
Winchendon	0	0	1	1	**1**
Winchester	6	4	246	31	**240**
Winthrop	252	86	237	98	**-15**
Woburn	2	1	8	3	**6**
Worcester	1	1	0	0	**-1**
Grand Total	**6,809**	**1,109**	**12,855**	**2,084**	**6,046**

Source: Massport, HMMH 2014.

Cumulative Noise Index (CNI)

Massport reports total annual fleet noise at Logan Airport, defined in the Logan Airport Noise Rules by a metric referred to as the CNI. The CNI is a single number representing the sum of the entire set of single-event noise levels experienced at the Airport over a full year of operation, weighted similarly to DNL so that activity occurring at night is penalized by adding an extra 10 dB to each event. This penalty is mathematically equivalent to multiplying the number of nighttime events by each aircraft by a factor of 10. The Logan Airport Noise Rules define CNI in terms of Effective Perceived Noise Level (EPNL) and require that the index be computed for the fleet of commercial aircraft operating at Logan Airport throughout the year. In addition, in EDRs and ESPRs, Massport reports partial CNI values of noise at Logan Airport, so that various subsets of the fleet (cargo, night operations, passenger jets, etc.) are identified (see Table H-14).

The Noise Rules, adopted by Massport following public hearings held in February 1986, established a CNI limit of 156.5 Effective Perceived Noise Decibels (EPNdB). The CNI generally has decreased since 1990, remaining below that cap, with changes from year to year on the order of a few tenths of a decibel. The 2012 and 2014 CNI remain well below the cap of 156.5 EPNL.

Table H-14 Cumulative Noise Index (EPNL) - 1990 to 2014

	Logan Airport CNI Cap – 156.5 EPNL									
Full CNI (Entire Commercial Jet Fleet)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
	156.4	**155.8**	**155.5**	**155.3**	**155.4**	**155.3**	**155.1**	**154.8**	**154.7**	**154.9**
Total Passenger Jets	155.2	154.8	154.6	154.4	154.4	154.2	154.1	153.9	153.7	153.9
Total Cargo Jets	150.1	148.9	148.0	147.9	148.3	148.8	148.6	147.5	147.9	148.0
Total Daytime	152.5	152.1	152.4	152.1	152.1	151.6	151.2	150.8	150.4	150.4
Total Nighttime	154.4	153.4	152.6	152.4	152.6	152.9	152.9	152.5	152.7	153.1
Total Stage 2 Jets	NA	NA	NA	NA	151.0	150.2	149.4	149.2	147.7	147.1
Total Stage 3 Jets	NA	NA	NA	NA	153.4	153.8	153.8	153.4	153.8	154.2
Daytime Stage 2	NA	NA	NA	NA	149.0	148.5	147.6	146.5	145.2	144.1
Nighttime Stage 2	NA	NA	NA	NA	146.7	145.1	144.8	145.8	144.1	144.0
Daytime Stage 3	NA	NA	NA	NA	149.1	148.8	148.7	148.8	148.9	149.2
Nighttime Stage 3	NA	NA	NA	NA	151.4	152.1	152.2	151.5	152.1	152.5
Passenger Jet Stage 2	NA	NA	NA	NA	150.5	149.9	149.2	148.9	147.5	146.8
Passenger Jet Stage 3	NA	NA	NA	NA	152.2	152.3	152.3	152.2	152.6	153.0
Cargo Jet Stage 2	NA	NA	NA	NA	141.5	137.4	136.8	137.4	139.0	134.5
Cargo Jet Stage 3	NA	NA	NA	NA	147.3	148.5	148.3	147.0	147.3	147.9
Daytime Passenger	NA	152.0	152.2	152.0	152.0	151.5	151.1	150.6	150.1	150.1
Nighttime Passenger	NA	151.6	150.9	150.6	150.8	151.0	151.0	151.1	151.2	151.6
Daytime Cargo	137.1	137.1	137.6	135.2	136.1	138.0	136.7	136.2	138.0	138.2
Nighttime Cargo	149.9	148.6	147.6	147.6	148.0	148.4	148.3	147.1	147.5	147.6
Daytime Passenger Stage 2	NA	NA	NA	NA	148.9	148.4	147.6	146.5	145.0	143.9
Daytime Passenger Stage 3	NA	NA	NA	NA	149.0	148.5	148.4	148.5	148.6	149.0
Nighttime Passenger Stage 2	NA	NA	NA	NA	149.0	148.5	148.4	148.5	142.8	143.7
Nighttime Passenger Stage 3	NA	NA	NA	NA	149.4	149.9	150.1	149.8	150.5	150.8
Daytime Cargo Stage 2	NA	NA	NA	NA	128.3	126.7	124.6	126.4	131.6	131.5
Daytime Cargo Stage 3	NA	NA	NA	NA	135.3	137.7	136.4	135.7	136.9	137.1
Nighttime Cargo Stage 2	NA	NA	NA	NA	141.3	137.0	136.5	137.0	138.2	131.5
Nighttime Cargo Stage 3	NA	NA	NA	NA	147.0	148.1	148.0	146.6	146.9	147.5

Table H-14 Cumulative Noise Index (EPNL) - 1990 to 2014 (Continued)

	Logan Airport CNI Cap – 156.5 EPNL									
Full CNI (Entire Commercial Jet Fleet)	**2000** **154.7**	**2001** **154.1**	**2002** **153.2**	**2003** **152.7**	**2004** **153.4**	**2005** **153.2**	**2006** **152.6**	**2007** **152.7**	**2008** **152.9**	**2009** **152.3**
Total Passenger Jets	153.6	152.9	151.8	151.3	152.2	152.1	151.4	151.5	151.9	151.1
Total Cargo Jets	148.2	147.8	147.4	147.1	147.0	146.6	146.5	146.4	146.1	145.9
Total Daytime	149.5	149.0	148.5	148.0	148.5	148.2	147.5	147.2	147.6	147.1
Total Nighttime	153.1	152.4	151.3	150.9	151.7	151.6	151.0	151.2	151.4	150.7
Total Stage 2 Jets	124.7	121.5	114.3	114.1	118.1	NA	NA	NA	NA	NA
Total Stage 3 Jets	154.7	154.1	153.2	152.7	153.4	153.2	152.6	152.7	152.9	152.3
Daytime Stage 2	122.6	119.3	111.2	113.7	109.4	NA	NA	NA	NA	NA
Nighttime Stage 2	120.5	117.3	111.4	103.2	117.5	NA	NA	NA	NA	NA
Daytime Stage 3	149.5	149.0	148.5	148.0	148.5	148.2	147.5	147.2	147.6	147.1
Nighttime Stage 3	153.1	152.4	151.3	150.9	151.7	151.6	151.0	151.2	151.4	150.7
Passenger Jet Stage 2	124.2	116.3	NA	NA	NA	NA	NA	NA	NA	NA
Passenger Jet Stage 3	153.6	152.9	151.8	151.3	152.2	152.1	151.4	151.5	151.9	151.1
Cargo Jet Stage 2	114.8	119.9	114.3	114.1	118.1	NA	NA	NA	NA	NA
Cargo Jet Stage 3	148.2	147.8	147.4	147.1	147.0	146.6	146.5	146.4	146.1	145.9
Daytime Passenger	149.3	148.7	148.2	147.7	148.2	147.9	147.2	146.9	147.3	146.8
Nighttime Passenger	151.6	150.8	149.4	148.8	150.0	150.1	149.3	149.7	150.0	149.1
Daytime Cargo	137.5	137.1	137.0	136.2	135.7	135.8	135.5	135.8	135.8	135.2
Nighttime Cargo	147.8	147.4	147.0	146.8	146.7	146.2	146.1	146.0	145.6	145.5
Daytime Passenger Stage 2	122.3	115.0	NA	NA	NA	NA	NA	NA	NA	NA
Daytime Passenger Stage 3	149.2	148.7	148.2	147.7	148.2	147.9	147.2	146.9	147.3	146.8
Nighttime Passenger Stage 2	119.8	110.2	NA	NA	NA	NA	NA	NA	NA	NA
Nighttime Passenger Stage 3	151.6	150.8	149.4	148.8	150.0	150.1	149.3	149.7	150.0	149.1
Daytime Cargo Stage 2	111.1	117.3	111.2	113.7	109.4	NA	NA	NA	NA	NA
Daytime Cargo Stage 3	137.5	137.0	137.0	136.1	135.7	135.8	135.5	135.8	135.8	135.2
Nighttime Cargo Stage 2	112.3	116.4	111.4	103.2	117.5	NA	NA	NA	NA	NA
Nighttime Cargo Stage 3	147.8	147.4	147.0	146.8	146.7	146.2	146.1	146.0	145.6	145.5

Table H-14	Cumulative Noise Index (EPNL) - 1990 to 2014 (Continued)					
	Logan Airport CNI Cap – 156.5 EPNL					
Full CNI (Entire Commercial Jet Fleet)	2010	2011	2012	2013	2014	Change 2013 to 2014
	151.9	**152.1**	**152.2**	**152.3**	**152.9**	**0.6**
Total Passenger Jets	150.9	150.6	151.3	151.4	152.2	0.8
Total Cargo Jets	145.1	146.7	144.9	145.1	144.5	-0.6
Total Daytime	146.8	146.9	147	147.0	147.5	0.5
Total Nighttime	150.3	150.6	150.6	150.8	151.3	0.5
Total Stage 2 Jets	113.6	110.8	104.9	111.3	NA	NA
Total Stage 3 Jets	151.9	152.1	152.2	152.3	152.9	0.6
Daytime Stage 2	103.6	NA	104.9	101.4	NA	NA
Nighttime Stage 2	113.1	110.8	NA	110.8	NA	NA
Daytime Stage 3	146.8	146.9	147	147.0	147.5	0.5
Nighttime Stage 3	150.3	150.6	150.6	150.8	151.3	0.5
Passenger Jet Stage 2	NA	NA	104.9	101.4	NA	NA
Passenger Jet Stage 3	150.9	150.6	151.3	151.4	152.2	0.8
Cargo Jet Stage 2	113.6	110.8	NA	110.8	NA	NA
Cargo Jet Stage 3	145.1	146.7	144.9	145.1	144.5	-0.6
Daytime Passenger	146.6	146.5	146.8	146.8	147.3	0.5
Nighttime Passenger	149.0	148.5	149.4	149.6	150.5	0.9
Daytime Cargo	134.5	136.6	134	133.6	134.9	1.3
Nighttime Cargo	144.7	146.3	144.5	144.8	144.0	-0.8
Daytime Passenger Stage 2	NA	NA	104.9	101.4	NA	NA
Daytime Passenger Stage 3	146.6	146.5	146.8	146.8	147.3	0.5
Nighttime Passenger Stage 2	NA	NA	NA	NA	NA	NA
Nighttime Passenger Stage 3	149.0	148.5	149.4	149.6	150.5	0.9
Daytime Cargo Stage 2	103.6	NA	NA	NA	NA	NA
Daytime Cargo Stage 3	134.4	136.6	134	133.6	134.9	1.3
Nighttime Cargo Stage 2	113.1	110.8	NA	110.8	NA	NA
Nighttime Cargo Stage 3	144.7	146.3	144.5	144.8	144.0	-0.8

Source: HMMH, 2014.
Notes: GA and non-jet aircraft are not included in the calculation.
NA = Not available.

Flight Track Monitoring Report

Introduction

As part of its ongoing commitment to mitigate noise at Logan Airport, Massport has undertaken evaluating the flight tracks of turbojet aircraft engaged in the implementation of established FAA noise abatement procedures. As is true for any airport operator, however, Massport has no authority to control where individual aircraft actually fly. That remains the responsibility of the FAA, while the individual pilots are responsible for safely executing the FAA's instructions. The flight procedures, which are used by the Air Traffic Control (ATC) staff at Boston Tower to achieve desired noise abatement tracks, are contained in the FAA's Tower Order (BOS TWR 7040.1).

This is the thirteenth annual report for flight track monitoring. Prior to 2002, Massport had issued semi-annual reports, an outgrowth of the Flight Track Monitoring Program study. That study was contained in the *Generic Environmental Impact Report* filed with Massachusetts Environmental Policy Act (MEPA) in July 1996, and was the subject of two Community Working Group workshops in September and October 1996. The twelfth annual report was published in *Appendix H, Noise Abatement* in the *2012*/2013 *EDR* and covered both 2012 and 2013. The information for 2013 is repeated in this report for reference. The period covered by this *2014 EDR* is January 1, 2014 through December 31, 2014.

The purpose of the ongoing monitoring program is to identify any systematic changes in flight tracks that may occur and to reduce flight track dispersion, where appropriate. The next report will cover the period January 1, 2015 through December 31, 2015, and will be included in the next EDR.

FAA Air Traffic Control (ATC) Procedures

FAA Tower Order BOS TWR 7040.1 entitled "Noise Abatement" describes the series of noise abatement policies, rules, regulations, and the procedures to be followed by the FAA air traffic controllers in meeting their designated responsibilities to be "a good neighbor, while meeting our operational objectives/responsibilities to the National Airspace System." Section 7.a.3 of the Order, subtitled "Turbojet Departure Noise Abatement Procedures," states that all turbojet departures shall be issued the Standard Instrument Departure (SID) procedure appropriate for the departure runway. They are paraphrased from the LOGAN SEVEN SID below.

Note in the descriptions that follow that terms such as "BOS 2 DME" are used frequently. Here, BOS refers to an aid to navigation known as the BOSTON VORTAC, a radio beacon physically located on Logan Airport near the eastern shoreline between the ends of Runways 27 and 33L (see Figure H-14). DME refers to "Distance Measuring Equipment," a co-located aid to navigation that provides pilots with a cockpit display of the number of nautical miles that the aircraft is from the designated radio beacon. Thus, BOS 2 DME means an aircraft should be two nautical miles away from the BOS. The term "vectored" means the pilot is assigned to fly a magnetic heading given by and at the discretion of the FAA air traffic controller to maintain the safe separation of aircraft. "MSL" is defined as feet above mean sea level and is the indicator of aircraft altitude used both by the pilot in the cockpit and the air traffic controller on the ground.

During 2010, several of the conventional-only (or radar vector) and RNAV procedures from the Boston Logan Airport Noise Study Categorical Exclusion (CATEX)[14] were implemented. There are eight new RNAV procedures

14 Federal Aviation Administration (FAA) Boston Logan Airport Noise Study Categorical Exclusion Record of Decision (CATEX ROD), Issued October 16, 2007

for departures from Logan Airport. These eight procedures are used by aircraft departing Runways 4R, 9, 15R, 22L, 22R, 27, and 33L (Runways 27 and 33L were added in 2014). These procedures primarily affected departures flying over the North and South shores and were designed to increase the amount of jet traffic crossing back over land above 6,000 feet to minimize noise impacts to communities. A ninth RNAV procedure, which is used by Runway 27, has been in use at the Airport and has been modified several times.

For departures, the conventional procedures (flown by non-RNAV equipped aircraft) from the LOGAN SEVEN SID are:

- For Runway 4R, climb heading 036 degrees to BOS 4 DME, then turn right to a heading of 090 degrees, and then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 9, climb heading 093 degrees, and then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 14, climb heading 142 degrees to BOS 1 DME, then turn left to heading 120 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 15R, climb heading 151 degrees to BOS 1 DME then turn left to 120 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runways 22R and 22L, climbing left turn to a heading of 140 degrees, then expect radar vectors to assigned route/navaid/fix. Aircraft that are initially vectored over water can expect to cross the coastline above 6,000 MSL before proceeding on course.
- For Runway 33L, climb heading 331 degrees to BOS 2 DME then turn left to 316 degrees, then expect radar vectors to assigned route/navaid/fix.
- For Runway 27, climb heading 273 to BOS 2.2 DME, then turn left heading 235 degrees, then expect radar vectors to assigned route/navaid/fix.

The RNAV procedures (used only by Turbojets) and the runways they serve:

- BLZZR TWO – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.
- BRUWN THREE – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean towards Cape Cod.
- CELTK THREE – Runways 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean.
- HYLND THREE – 4L, 9, 15R, 22L, 22R, 27, and 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the North Shore near Beverly.
- LBSTA THREE – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the North Shore near Manchester and Gloucester.
- PATSS THREE – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.

- REVSS TWO – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore near Cohasset and Scituate.
- SSOXS THREE – 4L, 9, 15R, 22L, 22R, 27, 33L: This procedure directs most jet traffic in a well-defined flight corridor over the ocean and crossing back over the South Shore over Marshfield.
- WYLYY ONE – 27: This procedure directs most jet traffic in a well-defined flight corridor on a heading of 273 degrees then a turn to 235 degrees over South Boston.

These brief procedural statements form the basis of the verbal instructions and flight clearances that are passed from controller to pilot to achieve reduced noise in the communities surrounding Logan Airport while also maintaining the safe and efficient flow of aircraft in and out of the Airport. However, consistency with which these procedures are used varies due to air traffic demands, controller workloads, weather conditions, and other operational factors, as noted in the Flight Track Monitoring Program Study.

Figure H-15 presents the gates used in the analysis for the Flight Track Monitoring Report. These gates are virtual vertical planes, which are used in the analysis to capture the aircraft flight paths. The gates are defined using a geographic coordinate for each end of the gate along with a floor and a ceiling altitude. The gates also capture direction of flights (in or out). The edges of each gate in Figure H-15 point in the direction that the aircraft is coming from. This information is used to evaluate the performance of the flight procedures off each runway end and is presented below. Figure H-15 also displays the BOS location, which is used for the distance measurements for the conventional procedures.

The RNAV procedures are still captured by the original flight track monitoring gates. Traffic crossing over the North Shore passes through the Marblehead Gate and traffic passing over the South Shore passes through the Hull 2, Hull 3, and Cohasset Gates. Turbojets departing Runway 27 on the RNAV pass through the Runway 27 gates and the new Runway 33L RNAV flight tracks still pass between the Somerville and Everett gates as expected.

Source: HMMH, MassGIS, USDA NAIP 2010

Logan Airport Flight Track Monitor Gates

Logan Flight Gates
Boston VOR/DME

Figure H-14

Statistical Analyses of Flight Tracks - Runway 4R

The Nahant Gate (Figure H-15) monitors aircraft after the first turn at 4 DME. The Swampscott and Marblehead Gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, and Cohasset Gates monitor southbound shoreline crossings.

Tables H-15a and H-15b show that Runway 4R departures for 2014 were concentrated, with 99.0 percent "over the Causeway," and about 0.2 percent over the south end of the gate compared to 99.2 percent over the Causeway in 2013 and 0.1 percent over the south end of the gate. Departures through the north end of the gate increased from 0.7 percent in 2013 to 0.8 percent in 2014.

Table H-15a Runway 4R Nahant Gate Summary for 2013

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North End of Gate	48	6,835	0.7%
Over Causeway	6,780	6,835	99.2%
South End of Gate	7	6,835	0.1%
Total	**6,835**	**6,835**	**100.0%**

Source: Massport, HMMH 2013.

Table H-15b Runway 4R Nahant Gate Summary for 2014

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North End of Gate	54	6,787	0.8%
Over Causeway	6,717	6,787	99.0%
South End of Gate	16	6,787	0.2%
Total	**6,787**	**6,787**	**100.00%**

Source: Massport, HMMH 2014.

Table H-16a and H-16b show how many of the shoreline crossings from Runway 4R were above 6,000 feet. For 2014, 96.9 percent of the flights were above 6,000 feet compared to 98.4 percent in 2013. The Swampscott gate had 30.0 percent of flights above 6,000 feet in 2014 compared to 24.2 percent in 2013. The number of flights through the Swampscott gate increased in 2014 (60 in 2013, up to 124 in 2014). The crossing percentage for this gate is historically lower than most gates due to its proximity to the Nahant gate itself. As seen in Figure H-15, the Swampscott gate is adjacent to the Nahant gate and aircraft would have to climb very quickly to be above 6,000 feet when crossing the Swampscott gate.

Table H-16a Runway 4R Shoreline Crossings Above 6,000 Feet for 2013

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	60	18	30.0%
Marblehead Gate	2,826	2,801	99.1%
Hull 2 Gate	291	291	100.0%
Hull 3 Gate	1,213	1,208	99.6%
Cohasset Gate	223	223	100.0%
Total	**4,613**	**4,541**	**98.4%**

Source: Massport, HMMH 2013.

Table H-16b Runway 4R Shoreline Crossings Above 6,000 Feet for 2014

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Swampscott Gate	124	30	24.2%
Marblehead Gate	2,856	2,817	98.6%
Hull 2 Gate	280	280	100.0%
Hull 3 Gate	856	855	99.9%
Cohasset Gate	181	181	100.0%
Total	**4,297**	**4,163**	**96.9%**

Source: Massport, HMMH 2014.

Statistical Analyses of Flight Tracks - Runway 9

The Winthrop 1 and Winthrop 2 gates (Figure H-15) monitor early turns for departures off Runway 9. The Revere, Swampscott, or Marblehead gates monitor northbound shoreline crossings, while the Hull 2, Hull 3, or Cohasset gates monitor southbound shoreline crossings.

Tables H-17a and H-17b show how many tracks turned prior to the BOS 2 DME. Northbound turns before BOS 2 DME pass through the Winthrop 1 Gate. Southbound traffic would pass through the Winthrop 2 Gate. In 2014, between both gates there were a total of 52 such turns, 0.1 percent. In 2013 52 tracks or 0.1 percent of the total also crossed these gates.

Table H-17a Runway 9 Gate Summary — Winthrop Gates 1 and 2 for 2013

	Number of Departure Tracks	Number of Tracks Through Gate	Percent Turning Before BOS 2 DME
Winthrop 1 Gate	44,851	20	<0.1%
Winthrop 2 Gate	44,851	32	0.1%
Total	**44,851**	**52**	**0.1%**

Source: Massport, HMMH 2013.

Table H-17b Runway 9 Gate Summary — Winthrop Gates 1 and 2 for 2014			
	Number of Departure Tracks	Number of Tracks Through Gate	Percent Turning Before BOS 2 DME
Winthrop 1 Gate	44,979	27	0.1%
Winthrop 2 Gate	44,979	25	0.1%
Total	**44,979**	**52**	**0.1%**

Source: Massport, HMMH 2014.

Table H-18a and H-18b indicate that 98.5 percent of Runway 9 departures were above 6,000 feet when crossing the shoreline in 2014, compared with 99.3 percent in 2013. The number of Runway 9 departures crossing back over the South Shore decreased from 34,370 in 2013 to 31,370 in 2014.

A decrease in the percentage above 6,000 feet occurred at the Revere gate (58.7 percent in 2013 to 43.7 percent in 2014) and a slight decrease at the Hull 2 gate (99.6 percent in 2013 to 99.0 percent in 2014).

The number of crossings decreased slightly for the Revere gate (46 in 2013 to 45 in 2014) and increased at the Swampscott gate (165 in 2013 to 316 in 2014). The Marblehead gate had a decrease in crossings (from 10,973 in 2013 to 10,596 in 2014), and an increase in the percent above 6,000 feet (from 99.5 percent in 2013 to 99.6 percent in 2014). Both the Hull 2 and Hull 3 gates had an increase in crossings compared to 2013. Hull 2 increased from 1,600 in 2013 to 1,920 in 2014 and Hull 3 increased from 3,640 in 2013 to 4,123 in 2014. The Hull 2 crossing percentage dropped slightly from 99.6 percent in 2013 to 99.0 percent in 2014, and the Hull 3 gate crossings decreased from 98.0 percent to 95.6 percent. The crossings through the Cohasset gate decreased (from 17,865 in 2013 to 14,156 in 2014) and the percent above 6,000 feet increased slightly from 98.6 percent in 2013 to 98.9 percent in 2014.

Table H-18a Runway 9 Shoreline Crossings Above 6,000 Feet for 2013			
	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	46	27	58.7%
Swampscott Gate	165	141	85.5%
Marblehead Gate	10,973	10,921	99.5%
Hull 2 Gate	1,607	1,600	99.6%
Hull 3 Gate	3,714	3,640	98.0%
Cohasset Gate	17,865	17,802	99.6%
Total	**34,370**	**34,131**	**99.3%**

Source: Massport, HMMH 2013.

Table H-18b Runway 9 Shoreline Crossings Above 6,000 Feet for 2014			
	Number of Tracks Through Gate	**Number Above 6,000 ft**	**Percentage Above 6,000 ft**
Revere Gate	45	21	46.7%
Swampscott Gate	316	278	88.0%
Marblehead Gate	10,596	10,552	99.6%
Hull 2 Gate	1,939	1,920	99.0%
Hull 3 Gate	4,318	4,126	95.6%
Cohasset Gate	14,156	13,994	98.9%
Total	**31,370**	**30,891**	**98.5%**

Source: Massport, HMMH 2014.

Statistical Analyses of Flight Tracks - Runway 15R

After takeoff, Runway 15R departures turn left approximately 30 degrees to avoid Hull, head out over Boston Harbor, and return back over the shore through the Swampscott and Marblehead Gates (Figure H-15) to the north, or through the Hull 2, Hull 3, and Cohasset Gates to the south. Tables H-19a and H-19b indicate that 98.2 percent of Runway 15R departures were above 6,000 feet when crossing the shoreline in 2014, compared with 99.5 percent in 2013. At 99.2 percent, the percent above 6,000 feet for the Swampscott Gate increased in 2014, from 95.8 percent in 2013. The Marblehead gate had an increase in crossings (from 1,598 in 2013 to 1,638 in 2014) and kept a constant 99.9 percent above 6,000 feet. The Hull 2 gate increased its percentage from 72.7 percent in 2013 to 100 percent in 2014, and the Hull 3 gate decreased from 93.1 percent in 2013 to 83.2 percent in 2014. The Cohasset gate had a decrease in crossings (from 2,853 in 2013 to 2,207 in 2015) and the percent above 6,000 feet decreased from 99.8 percent to 98.1 percent.

Table H-19a Runway 15R Shoreline Crossings Above 6,000 Feet for 2013			
	Number of Tracks Through Gate	**Number Above 6,000 ft**	**Percentage Above 6,000 ft**
Swampscott Gate	71	68	95.8%
Marblehead Gate	1,598	1,596	99.9%
Hull 2 Gate	11	8	72.7%
Hull 3 Gate	159	148	93.1%
Cohasset Gate	2,853	2,848	99.8%
Total	**4,692**	**4,668**	**99.5%**

Source: Massport, HMMH 2013.

Table H-19b Runway 15R Shoreline Crossings Above 6,000 Feet for 2014			
	Number of Tracks Through Gate	**Number Above 6,000 ft**	**Percentage Above 6,000 ft**
Swampscott Gate	120	119	99.2%
Marblehead Gate	1,638	1,636	99.9%
Hull 2 Gate	4	4	100.0%
Hull 3 Gate	191	159	83.2%
Cohasset Gate	2,207	2,166	98.1%
Total	**4,160**	**4,084**	**98.2%**

Source: Massport, HMMH 2014.

Statistical Analyses of Flight Tracks - Runways 22R and 22L

The Squantum 2 and Hull 1 Gates (Figure H-15) are used to monitor the turn to 140 degrees over Boston Harbor and north of Hull. The shoreline gates are used to monitor shoreline crossings, as for Runways 4R, 9, and 15R above.

Tables H-20a and H-20b show the dispersion of the jet departures from Runways 22R and 22L as they pass through the Squantum 2 Gate. The first segment of the gate is the northernmost segment and is primarily over Boston Harbor. The other segments extend southward toward Quincy. The percentage of tracks passing through the first two segments of this gate increased from 88.2 percent in 2013 to 89.5 percent in 2014.

Table H-20a Runways 22R and 22L Squantum 2 Gate Summary for 2013			
	Number of Tracks Through Gate Segment	**Total Number of Tracks Through All Gate Segments**	**Percentage of Tracks Through Gate Segment**
0 - 12,000 ft	6,143	55,064	11.2%
12,000 - 14,000 ft	42,424	55,064	77.0%
14,000 - 21,000 ft	6,453	55,064	11.7%
21,000 - 27,000 ft	44	55,064	0.1%
Total	**55,064**	**55,064**	**100.0%**

Source: Massport, HMMH 2013.
Note: Percentages sum to more than 100 percent due to rounding.

Table H-20b Runways 22R and 22L Squantum 2 Gate Summary for 2014

	Number of Tracks Through Gate Segment	Total Number of Tracks Through All Gate Segments	Percentage of Tracks Through Gate Segment
0 - 12,000 ft	2,297	44,093	5.2%
12,000 - 14,000 ft	37,161	44,093	84.3%
14,000 - 21,000 ft	4,594	44,093	10.4%
21,000 - 27,000 ft	41	44,093	0.1%
Total	**44,093**	**44,093**	**100.0%**

Source: Massport, HMMH 2014.
Note: Percentages sum to more than 100 percent due to rounding.

Tables H-21a and H-21b show that the percent of tracks crossing north of the Hull peninsula as they passed through the Hull 1 Gate remains constant at 98.9 percent in both 2013 and 2014.

Table H-21a Runways 15R, 22R, and 22L Hull 1 Gate Summary – North of Hull Peninsula for 2013

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North of Hull Peninsula	61,493	62,199	98.9%
Over Hull	706	62,199	1.1%
Total	**62,199**	**62,199**	**100.0%**

Source: Massport, HMMH 2013

Table H-21b Runways 15R, 22R, and 22L Hull 1 Gate Summary – North of Hull Peninsula for 2014

	Number of Tracks Through Gate Segment	Total Number of Tracks Through Gate	Percentage of Tracks Through Gate Segment
North of Hull Peninsula	50,327	50,909	98.9%
Over Hull	582	50,909	1.1%
Total	**50,909**	**50,909**	**100.0%**

Source: Massport, HMMH 2014.

Tables H-22a and H-22b indicate that 98.9 percent of Runway 22R/22L departures were above 6,000 feet when crossing the shoreline in 2014, compared with 99.8 percent in 2013. For the Revere gate, the percent above 6,000 feet decreased from 98.1 percent in 2013 to 95.9 percent in 2014. The Swampscott gate increased from 95.8 percent in 2013 to 99.1 percent in 2014. The Marblehead gate had a decrease in crossings (from 14,362 in 2013 to 11,027 in 2014) and the percent above 6,000 feet remained the same as 2011 at nearly 100 percent. The Hull 2 gate decreased in percent above 6,000 feet from 96.3 percent in 2013 to 91.3 percent in 2014. The Hull 3 gate decreased in percent above 6,000 feet from 99.9 percent in 2013 to 93.1 percent in 2014. The number of crossings for the Cohasset gate decreased (24,108 in 2013 to 17,117 in 2014) and the percentage slightly decreased from 99.9 percent in 2013 to 98.8 percent in 2014.

Table H-22a Runways 22R and 22L Shoreline Crossings Above 6,000 Feet for 2013

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	54	53	98.1%
Swampscott Gate	343	338	98.5%
Marblehead Gate	14,362	14,357	100.0%
Hull 2 Gate	27	26	96.3%
Hull 3 Gate	1,027	997	97.1%
Cohasset Gate	24,108	24,072	99.9%
Total	**39,921**	**39,843**	**99.8%**

Source: Massport, HMMH 2013.

Table H-22b Runways 22R and 22L Shoreline Crossings Above 6,000 Feet for 2014

	Number of Tracks Through Gate	Number Above 6,000 ft	Percentage Above 6,000 ft
Revere Gate	73	70	95.9%
Swampscott Gate	444	440	99.1%
Marblehead Gate	11,027	11,021	99.9%
Hull 2 Gate	23	21	91.3%
Hull 3 Gate	1,318	1227	93.1%
Cohasset Gate	17,117	16,904	98.8%
Total	**30,002**	**29,683**	**98.9%**

Source: Massport, HMMH 2014.

Runway 27

On September 15, 1996, the FAA implemented a new departure procedure for Runway 27 called the WYLYY RNAV procedure. In accordance with the provisions of the ROD issued for the Runway 27 Environmental Impact Statement, Massport has been providing on-going radar flight track data and analysis to the FAA with respect to the procedure.

In 2012, for the first time since 1997 when flight track monitoring began, each gate (Gates A through E) averaged over 68 percent for every month the Airport had all runways open and for the annual average. The percent of flight tracks through all gates (a number tracked but not required per the 1996 ROD) rounded up to 68 percent for the last two months of 2011 and continued for all of 2012. The FAA had discussed these data internally and concluded that acceptable flight track dispersion had been achieved and that no subsequent action by FAA is required per the 1996 ROD requirements.[15]

15 Logan Airport Runway 27 Advisory Committee Meeting - January 23, 2012 meeting minutes

Massport will continue to provide Tables H-23a and H-23b in the subsequent annual reports. Table H-23a presents the conformance results for the Runway 27 corridor for 2013 and Table H-23b for 2014. The average percentage of tracks through the corridor was 75.0 percent for 2013 and 76.8 percent for 2014.

Each gate is further from the runway and falls along the procedure. The gates also increase in width as the distance is increased along the flight path and they form a noise abatement corridor. A consistent percentage of traffic through each gate means that flights are not entering the corridor late or exiting the corridor too early. The average percent through each gate was 90.0 percent in 2013 and 92.2 percent in 2014, which means that the majority of the traffic remained in the corridor.

Table H-23a Runway 27 Corridor Percent of Tracks Through Each Gate for 2013

Month	Total # of Tracks	Total # of Tracks Through All Gates	Percent of Tracks Through All Gates	Gate A 1,400 ft[1]	Gate B 2,200 ft[1]	Gate C 2,900 ft[1]	Gate D 4,700 ft[1]	Gate E 6,300 ft[1]	Average Percent Through Each Gate
January	2,409	1,807	75.0%	80.7%	90.5%	95.4%	98.1%	95.6%	92.1%
February	1,152	846	73.4%	79.5%	88.8%	93.8%	97.3%	94.9%	90.9%
March	2,986	2,335	78.2%	82.6%	90.8%	96.2%	98.3%	97.5%	93.1%
April	1,364	1,093	80.1%	83.1%	91.9%	95.6%	97.1%	97.1%	93.0%
May	758	580	76.5%	81.8%	88.8%	95.0%	96.0%	95.7%	91.5%
June	981	728	74.2%	77.4%	85.2%	90.8%	92.1%	92.0%	87.5%
July[2]	439	292	66.5%	67.9%	78.4%	82.7%	86.6%	87.7%	80.6%
August[2]	799	595	74.5%	77.6%	87.9%	92.2%	93.6%	92.9%	88.8%
September[2]	540	394	73.0%	75.0%	85.4%	90.4%	91.9%	90.9%	86.7%
October	1,077	813	75.5%	77.4%	89.5%	93.9%	96.3%	95.8%	90.6%
November	2,454	1,901	77.5%	80.9%	92.2%	95.9%	97.8%	97.2%	92.8%
December	2,853	2,164	75.9%	79.4%	90.7%	96.1%	98.4%	97.7%	92.5%
Average[2]	**1,484**	**1129**	**75.0%**	**78.6%**	**88.3%**	**93.2%**	**95.3%**	**94.6%**	**90.0%**

Source: Massport, HMMH 2013.
Notes: Gray shading indicates the percentage rounds up to 68 percent or greater.
1 Width of each gate in feet.
2 Runway 33L completely closed June 16, 2012 - October 2, 2012, RSA project, reduced use of Runway 27 departures. Excluded from overall average.

Table H-23b Runway 27 Corridor Percent of Tracks Through Each Gate for 2014									
Month	Total # of Tracks	Total # of Tracks Through All Gates	Percent of Tracks Through All Gates	Gate A 1,400 ft[1]	Gate B 2,200 ft[1]	Gate C 2,900 ft[1]	Gate D 4,700 ft[1]	Gate E 6,300 ft[1]	Average Percent Through Each Gate
January	1,841	1,396	75.8%	78.0%	91.6%	95.8%	97.7%	97.3%	92.1%
February	2,132	1591	74.6%	78.0%	90.9%	95.2%	97.1%	96.1%	91.4%
March	1,461	1,134	77.6%	80.4%	92.0%	96.9%	98.0%	97.0%	92.9%
April	1,609	1,237	76.9%	80.1%	91.9%	95.3%	96.7%	96.1%	92.0%
May	1301	1045	80.3%	82.5%	93.4%	97.7%	98.6%	98.1%	94.1%
June	1135	863	76.0%	78.4%	91.0%	95.2%	97.4%	97.1%	91.8%
July	1192	876	73.5%	75.5%	89.1%	94.1%	96.5%	95.6%	90.2%
August	1033	770	74.5%	76.7%	89.5%	96.1%	98.4%	97.6%	91.6%
September	1381	1117	80.9%	83.1%	91.8%	94.7%	96.0%	95.9%	92.3%
October	1,836	1373	74.8%	78.2%	91.1%	95.0%	97.3%	96.2%	91.6%
November	2,797	2,194	78.4%	81.3%	92.8%	96.1%	97.6%	97.0%	92.9%
December	1,410	1,100	78.0%	80.6%	92.8%	96.8%	98.2%	97.3%	93.1%
Average	**1,594**	**1,225**	**76.8%**	**79.4%**	**91.5%**	**95.7%**	**97.5%**	**96.8%**	**92.2%**

Source: Massport, HMMH 2014.
Notes: Gray shading indicates the percentage rounds up to 68 percent or greater.
1 Width of each gate in feet.

Statistical Analyses of Flight Tracks — Runway 33L

The Somerville and Everett Gates (Figure H-15) extend from BOS 2 DME to BOS 5 DME and are used to monitor the departure procedure for Runway 33L. Turns to the left prior to the BOS 5 DME would pass through the Somerville Gate. Turns to the right prior to the BOS 5 DME would pass through the Everett Gate.

Tables H-24a and H-24b indicate the percentage of tracks turning before BOS 5 DME decreases from 4.1 percent in to 2.0 percent in 2014. The total number of tracks increased from 18,643 in 2013 to 25,412 in 2014.

Table H-24a Runway 33L Gates — Passages Below 3,000 Feet for 2013			
	Number of Departure Tracks	Number of Tracks Turning Before BOS 5 DME	Percentage of Tracks Turning Before BOS 5 DME
Everett Gate	18,643	404	2.2%
Somerville Gate	18,643	357	1.9%
Total	**18,643**	**761**	**4.1%**

Source: Massport, HMMH 2013.

Table H-24b Runway 33L Gates — Passages Below 3,000 Feet for 2014			
	Number of Departure Tracks	Number of Tracks Turning Before BOS 5 DME	Percentage of Tracks Turning Before BOS 5 DME
Everett Gate	25,412	229	0.9%
Somerville Gate	25,412	285	1.1%
Total	**25,412**	**514**	**2.0%**

Source: Massport, HMMH 2014.

Table H-25 provides the level of traffic off each runway end in 2013 and 2014. These percent's represent the amount of activity experienced off each runway end for a given year.

Table H-25 Runway Usage by Runway End					
		2013		2014	
By Runway End	Operations(s)	Total Flights	% of Total	Total Flights	% of Total
04L	R4L A + R22R D	80,038	22.2%	67,385	18.5%
04R	R4R A + R22L D	50,922	14.1%	52,984	14.6%
09	R9 A + R27 D	18,925	5.2%	21,220	5.8%
14	n/a	0	0.0%	0	0.0%
15L	R15L A + R33R D	54	0.0%	69	0.0%
15R	R15R A + R33L D	24,273	6.7%	34,887	9.6%
22L	R22L A + R4R D	39,399	10.9%	54,116	14.9%
22R	R22R A + R4L D	6,153	1.7%	6,977	1.9%
27	R27 A + R9 D	103,500	28.6%	85,064	23.4%
32	R32 A + R14 D	3,221	0.9%	4,751	1.3%
33L	R33L A + R15R D	33,692	9.3%	35,480	9.8%
33R	R33R A + R15L D	1,160	0.3%	865	0.2%
All		**361,338**	**100.0%**	**363,797**	**100.0%**

Notes: A=Arrivals
1 D=Departures

2014 DNL Levels for Census Block Group Locations

Table H-26 reports the DNL value for each Census block group down to the DNL 50 dB

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB

US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250250408013	Charlestown	2,011	1,296	54.3	54.3
250250408012	Charlestown	789	263	53.9	55.1
250250402001	Charlestown	775	304	53.9	54.0
250250408011	Charlestown	1,061	530	53.4	53.4
250250403001	Charlestown	739	334	53.0	53.0
250250402002	Charlestown	831	423	53.0	53.1
250250403004	Charlestown	617	320	52.6	52.6
250250401001	Charlestown	958	555	52.4	52.3
250250403002	Charlestown	1,247	662	52.4	52.3
250250403003	Charlestown	657	366	52.4	52.4
250250406002	Charlestown	1,581	843	52.1	52.2
250250403005	Charlestown	622	355	51.9	51.9
250250401002	Charlestown	1,210	684	51.9	52.0
250250404012	Charlestown	750	456	51.6	51.2
250250404011	Charlestown	1,689	766	51.5	51.4
250250406001	Charlestown	863	485	51.5	52.2
250251006032	Dorchester	598	284	59.5	59.7
250251007002	Dorchester	1,027	526	56.3	58.6
250251007003	Dorchester	672	290	55.7	55.8
250251006031	Dorchester	1,306	556	55.5	55.9
250250913002	Dorchester	1,131	388	55.0	55.0
250250907004	Dorchester	651	302	54.5	55.5
250251007001	Dorchester	1,050	484	54.0	53.8
250250913001	Dorchester	1,368	480	53.3	53.3
250250907002	Dorchester	1,253	644	52.9	53.0
250250914001	Dorchester	1,672	584	52.6	52.8
250251007004	Dorchester	856	371	52.5	52.5
250250909012	Dorchester	2,092	1,034	52.4	55.2
250251006011	Dorchester	1,094	488	51.9	51.8
250250907003	Dorchester	1,153	526	51.9	52.0
250251007005	Dorchester	717	303	51.9	51.8
250250912003	Dorchester	742	296	51.8	51.9
250250912001	Dorchester	1,081	451	51.6	51.7
250250907001	Dorchester	1,218	518	51.3	51.5
250250909011	Dorchester	1,627	606	50.8	50.4

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250250921011	Dorchester	1,113	467	50.7	50.8
250250915001	Dorchester	1,978	744	50.6	50.3
250250915002	Dorchester	1,494	547	50.5	50.5
250250911005	Dorchester	817	297	50.5	50.5
250250912002	Dorchester	1,411	492	50.5	50.6
250250918001	Dorchester	1,517	517	50.5	50.4
250251006012	Dorchester	898	382	50.4	50.2
250250918003	Dorchester	933	357	50.4	50.5
250250921013	Dorchester	729	321	50.3	51.8
250250919001	Dorchester	1,042	329	50.2	50.2
250251008004	Dorchester	1,117	666	50.2	52.7
250250918002	Dorchester	1,002	340	50.1	50.2
250251008003	Dorchester	899	412	50.0	50.0
250250911001	Dorchester	1,395	625	50.0	50.0
250250910013	Dorchester	682	335	49.5	50.7
250250701011	Downtown Boston	816	529	54.8	56.6
250250305001	Downtown Boston	650	442	54.2	53.9
250250303001	Downtown Boston	1,757	1,283	54.1	54.0
250250702002	Downtown Boston	1,133	444	54.0	54.1
250250305002	Downtown Boston	1,025	687	53.7	53.7
250250305003	Downtown Boston	809	527	53.6	53.5
250250701018	Downtown Boston	422	246	53.4	53.5
250250304001	Downtown Boston	1,519	994	53.3	53.2
250250702001	Downtown Boston	1,458	599	53.3	53.3
250250303002	Downtown Boston	963	696	53.3	53.0
250250304002	Downtown Boston	932	665	53.0	52.9
250250301001	Downtown Boston	1,053	790	52.9	52.9
250250701017	Downtown Boston	1,102	701	52.7	52.8
250250301002	Downtown Boston	901	587	52.5	52.5
250250302001	Downtown Boston	1,665	1,103	52.5	52.4
250250303004	Downtown Boston	548	465	52.1	52.2
250250701012	Downtown Boston	195	90	52.0	51.9
250250203032	Downtown Boston	512	365	51.7	51.1
250250702003	Downtown Boston	2,619	647	51.7	51.7
250250303003	Downtown Boston	1,192	503	51.6	51.7

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250250701016	Downtown Boston	366	325	51.6	51.6
250250701015	Downtown Boston	223	161	51.5	51.3
250250701013	Downtown Boston	494	381	51.2	51.2
250250701014	Downtown Boston	1,887	941	51.1	51.1
250250703002	Downtown Boston	733	449	51.0	50.9
250250203031	Downtown Boston	878	693	50.7	50.7
250250203033	Downtown Boston	1,179	789	50.6	50.6
250250203012	Downtown Boston	1,673	1,209	50.3	50.3
250250203011	**Downtown Boston**	**350**	**205**	**50.1**	**49.8**
250250509011	Eagle Hill East Boston	1,283	420	66.7	67.9
250250509012	Eagle Hill East Boston	1,964	717	64.2	64.0
250250509013	Eagle Hill East Boston	918	309	64.1	65.0
250250507003	Eagle Hill East Boston	1,476	505	62.5	62.8
250250502004	Eagle Hill East Boston	1,055	349	62.4	62.3
250250502003	Eagle Hill East Boston	836	283	62.1	62.0
250250507002	Eagle Hill East Boston	1,344	484	61.2	61.2
250250501011	Eagle Hill East Boston	1,713	534	60.7	61.2
250250501013	Eagle Hill East Boston	1,930	684	60.1	60.2
250250507001	Eagle Hill East Boston	1,684	617	59.9	60.2
250250502002	Eagle Hill East Boston	1,151	445	59.3	59.2
250250502001	Eagle Hill East Boston	2,189	757	59.3	59.3
250250501012	Eagle Hill East Boston	1,472	632	59.1	58.5
250251202012	Jamaica Plain	1,841	894	52.2	52.2
250251202013	Jamaica Plain	451	221	52.2	52.2
250251202011	Jamaica Plain	1,147	611	50.5	50.7
250251201041	**Jamaica Plain**	**516**	**252**	**50.0**	**49.7**
250251204002	Jamaica Plain	676	363	49.9	50.0
250250512001	Jefferies Point	32	19	60.9	59.7
250250512002	Jefferies Point	1,548	692	60.6	60.4
250250512003	Jefferies Point	799	449	59.4	59.6
250250924004	Mattapan	1,142	413	51.4	51.6
250259811004	Mattapan	187	128	51.1	51.9
250251001001	Mattapan	167	61	50.6	50.9
250250511013	Orient Heights	1,537	621	65.1	65.3
250250511014	Orient Heights	910	385	62.8	59.7

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB

US Census 2010 Block Group					
Block ID	Neighborhood	Population	Housing Units	Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
250250511011	Orient Heights	1,602	598	62.1	61.3
250250511012	Orient Heights	1,949	741	61.3	61.1
250250510001	Other East Boston	2,039	855	66.3	66.3
250250510003	Other East Boston	1,088	467	64.1	64.0
250250510002	Other East Boston	962	462	63.7	60.8
250250505001	Other East Boston	1,857	702	60.5	60.4
250250506001	Other East Boston	1,248	494	59.1	59.2
250250506002	Other East Boston	815	312	58.6	58.9
250250504002	Other East Boston	1,735	797	58.5	58.5
250250504001	Other East Boston	637	237	57.9	57.9
250250503001	Other East Boston	727	282	57.8	57.0
250250503002	Other East Boston	1,524	759	57.0	56.7
250259813002	Other East Boston*	389	244	61.6	88.6
250251101031	Roslindale	568	325	52.9	52.8
250259811003	Roslindale	6	5	52.8	53.3
250251101036	Roslindale	583	271	52.4	52.4
250251101035	Roslindale	1,440	666	52.3	52.2
250251103012	Roslindale	1,271	552	52.1	52.5
250251101034	Roslindale	620	289	51.8	51.7
250251103011	Roslindale	1,134	403	51.7	52.0
250251101033	Roslindale	653	241	50.4	51.3
250251102011	Roslindale	2,051	874	50.1	50.8
250251104011	**Roslindale**	**1,185**	**417**	**50.0**	**49.8**
250250801001	Roxbury	1,096	450	57.0	57.5
250250906001	Roxbury	1,094	351	56.6	56.6
250250801002	Roxbury	738	294	56.6	56.6
250250818002	Roxbury	921	442	56.5	56.4
250250906002	Roxbury	1,254	442	56.4	56.6
250250904004	Roxbury	870	294	56.3	56.2
250250818003	Roxbury	820	369	56.1	56.1
250250818001	Roxbury	1,157	577	55.9	56.0
250250904003	Roxbury	763	254	55.7	55.7
250250820003	Roxbury	841	414	55.7	55.8
250250820002	Roxbury	682	298	55.5	55.6
250250803001	Roxbury	1,769	791	55.5	55.5

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250250817002	Roxbury	893	430	55.5	55.6
250250820001	Roxbury	1,292	566	55.4	55.5
250250821003	Roxbury	2,244	1,012	55.4	55.4
250250904001	Roxbury	871	311	55.3	55.2
250250819001	Roxbury	906	453	55.1	55.4
250250904002	Roxbury	1,155	435	55.1	55.0
250250821001	Roxbury	1,228	526	55.0	55.1
250250819004	Roxbury	992	428	54.9	54.9
250250817001	Roxbury	619	225	54.8	55.2
250250819003	Roxbury	600	257	54.7	54.7
250250821002	Roxbury	1,553	579	54.7	54.7
250250819002	Roxbury	617	259	54.7	54.9
250250903003	Roxbury	978	422	54.5	54.6
250250903002	Roxbury	1,310	513	54.3	53.6
250250817003	Roxbury	780	291	54.2	54.0
250259803001	Roxbury	2	2	54.1	53.9
250250817004	Roxbury	878	355	54.0	53.8
250250914002	Roxbury	1,047	355	53.9	53.9
250250804011	Roxbury	1,265	526	53.6	53.7
250250901001	Roxbury	1,631	655	53.4	53.5
250250817005	Roxbury	641	298	53.4	53.2
250250903001	Roxbury	891	333	53.3	53.0
250250902003	Roxbury	934	308	53.1	53.4
250250813001	Roxbury	1,661	806	53.1	53.1
250250815002	Roxbury	1,346	554	53.1	53.1
250251203013	Roxbury	1,543	554	52.8	53.1
250251203012	Roxbury	855	331	52.7	52.8
250250902002	Roxbury	626	278	52.5	53.1
250250901003	Roxbury	693	303	52.3	52.4
250250901002	Roxbury	531	237	52.1	52.1
250250902001	Roxbury	673	244	51.9	51.7
250250815001	Roxbury	788	351	51.6	51.5
250250806013	Roxbury	448	242	51.3	51.3
250250924005	Roxbury	721	276	51.2	51.2
250251203014	Roxbury	1,231	567	51.1	50.9

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB

US Census 2010 Block Group					
Block ID	Neighborhood	Population	Housing Units	Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
250250901004	Roxbury	1,099	414	51.1	50.9
250250924003	Roxbury	1,688	711	51.0	50.9
250250804012	Roxbury	1,445	723	51.0	51.1
250251203011	Roxbury	1,166	443	51.0	50.6
250250814001	Roxbury	1,067	558	50.8	51.0
250250813002	Roxbury	1,749	690	50.5	50.6
250250813003	**Roxbury**	**874**	**335**	**50.7**	**49.9**
250250901005	Roxbury	617	249	50.4	50.4
250250612001	South Boston	1,702	1,158	59.8	59.7
250250601011	South Boston	881	441	59.2	59.4
250250601013	South Boston	981	496	59.1	59.0
250250607001	South Boston	741	253	59.1	59.0
250250606001	South Boston	2,357	1,530	58.9	62.6
250250601012	South Boston	633	350	58.8	58.7
250250607002	South Boston	1,152	383	58.5	58.6
250250601014	South Boston	721	397	58.0	58.0
250250608003	South Boston	886	470	57.1	57.1
250250608004	South Boston	1,666	943	56.7	57.0
250250605014	South Boston	631	295	56.5	56.1
250250608002	South Boston	757	396	56.1	56.1
250250605015	South Boston	656	333	56.0	55.9
250250612002	South Boston	627	383	55.9	57.5
250250602001	South Boston	821	419	55.6	55.7
250250608001	South Boston	655	333	55.5	55.5
250250605013	South Boston	717	431	55.2	55.2
250250605011	South Boston	699	375	55.0	55.0
250250602002	South Boston	1,095	580	55.0	54.6
250250605012	South Boston	868	508	54.8	54.8
250250612003	South Boston	911	470	54.7	54.7
250250604005	South Boston	678	336	54.5	54.3
250250610001	South Boston	1,033	544	54.5	54.4
250250610003	South Boston	901	393	54.5	54.1
250250603013	South Boston	1,092	561	54.2	54.0
250250610002	South Boston	1,164	471	54.2	54.1
250250603011	South Boston	1,285	741	53.9	53.7

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250250611011	South Boston	617	278	53.9	53.7
250250604001	South Boston	1,021	542	53.7	53.9
250250603012	South Boston	699	345	53.4	53.3
250250604004	South Boston	1,093	669	53.2	53.1
250250604002	South Boston	988	530	53.1	53.2
250250611012	South Boston	1,615	756	52.9	52.7
250250604003	South Boston	842	466	52.8	52.7
250250712011	South End	1,790	819	55.8	56.6
250250712012	South End	1,232	578	54.9	55.3
250250711011	South End	1,420	928	54.9	55.0
250250711012	South End	1,424	750	54.0	55.4
250250711013	South End	831	507	53.9	54.4
250250705001	South End	1,700	1,018	53.3	53.3
250250704021	South End	1,626	680	53.2	54.8
250250705003	South End	1,393	803	52.6	52.7
250250705002	South End	999	524	52.0	52.1
250250705004	South End	1,353	721	52.0	52.0
250250709001	South End	2,166	1,231	51.6	51.4
250250703004	South End	1,119	746	51.1	51.2
250250709002	South End	1,163	567	51.0	51.0
250250706001	South End	1,127	667	50.9	50.8
250250805002	South End	2,020	863	50.9	51.0
250250706002	South End	1,113	642	50.1	50.1
250250703003	South End	992	707	49.9	50.2
250250203021	Back Bay	1,181	721	50.5	50.4
250250703001	**Back Bay**	**1,065**	**804**	**50.1**	**49.8**
250250202001	Back Bay	1,266	897	49.9	50.0
250173521012	Cambridge	1,473	1,187	49.8	50.3
250251602003	Chelsea	1,497	494	63.6	63.9
250251601015	Chelsea	1,025	261	62.9	63.3
250251603002	Chelsea	596	366	62.5	60.1
250251602002	Chelsea	1,210	374	62.2	62.1
250251603001	Chelsea	1,469	913	60.8	59.9
250251601011	Chelsea	1,332	353	60.6	60.5
250251604002	Chelsea	1,783	683	60.6	60.1

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250251601013	Chelsea	1,576	568	60.3	61.1
250251602001	Chelsea	1,336	357	60.0	60.0
250251604001	Chelsea	933	344	59.1	59.5
250251601012	Chelsea	1,372	438	58.6	58.4
250251601014	Chelsea	2,092	539	57.3	57.3
250251605022	Chelsea	1,359	477	56.0	57.3
250251605021	Chelsea	1,703	623	55.8	56.6
250251605013	Chelsea	774	233	55.7	55.6
250251605023	Chelsea	1,398	488	55.6	55.5
250251605012	Chelsea	1,231	396	55.1	55.1
250251605014	Chelsea	754	392	54.9	54.8
250251605015	Chelsea	748	304	54.2	54.2
250251606011	Chelsea	2,158	1,005	54.1	53.7
250251605011	Chelsea	2,097	646	54.0	53.8
250251606012	Chelsea	1,905	563	53.3	53.3
250251606024	Chelsea	780	271	52.1	52.1
250251606021	Chelsea	1,290	470	51.8	51.7
250251606025	Chelsea	985	409	51.8	51.8
250251606022	Chelsea	795	304	50.8	50.8
250251606023	Chelsea	825	346	50.6	50.7
250173424004	Everett	1,348	517	58.3	58.7
250173424003	Everett	905	346	57.6	55.9
250173424002	Everett	1,132	480	56.7	57.3
250173424001	Everett	1,878	847	55.9	55.8
250173425003	Everett	2,200	970	54.8	54.6
250173423003	Everett	2,137	858	53.4	53.3
250173426002	Everett	904	347	52.6	52.9
250173424005	Everett	792	363	52.0	51.8
250173423004	Everett	1,807	805	51.9	52.2
250173426003	Everett	2,336	941	51.8	51.7
250173425002	Everett	2,169	870	51.7	51.6
250173426001	Everett	1,125	395	51.3	51.2
250173423002	Everett	1,555	596	51.0	50.9
250173423001	**Everett**	**1,327**	**495**	**50.1**	**49.9**
250173421014	Everett	943	362	50.1	50.0

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250235001011	**Hull**	**1,502**	**828**	**54.8**	**49.1**
250235001012	**Hull**	**819**	**452**	**51.0**	**49.7**
250092072002	Lynn	1,727	789	56.7	56.8
250092071002	Lynn	992	307	56.6	56.7
250092070002	Lynn	1,235	456	56.4	56.8
250092061002	Lynn	2,051	665	56.3	56.4
250092072001	Lynn	1,211	391	55.9	58.5
250092055002	Lynn	2,552	961	55.8	55.8
250092060001	Lynn	1,443	478	55.5	55.7
250092071001	Lynn	1,446	444	55.1	55.5
250092061001	Lynn	1,793	797	55.0	55.1
250092062002	Lynn	2,267	786	54.9	55.4
250092052004	Lynn	1,435	511	54.9	55.0
250092070001	Lynn	876	585	54.6	52.5
250092052002	Lynn	714	277	54.2	54.4
250092060002	Lynn	1,916	642	54.1	54.5
250092071003	Lynn	1,075	342	54.0	54.1
250092051005	Lynn	637	264	53.9	54.2
250092052003	Lynn	1,510	564	53.7	53.7
250092062003	Lynn	1,859	573	53.4	53.0
250092051004	Lynn	1,527	556	52.9	53.5
250092062001	Lynn	1,128	327	52.9	52.9
250092051003	Lynn	919	361	52.5	52.7
250092052001	Lynn	806	410	52.0	53.1
250092052005	Lynn	854	385	51.9	54.4
250092058002	Lynn	1,089	342	51.9	52.0
250092063004	Lynn	1,040	367	51.9	51.9
250092055001	Lynn	2,054	736	51.7	50.7
250092059001	Lynn	1,743	598	51.5	51.6
250092068002	Lynn	1,792	914	51.4	51.3
250092058001	Lynn	1,044	362	51.2	51.7
250092059002	Lynn	1,262	443	50.7	50.6
250092058003	Lynn	1,179	435	50.6	50.3
250092051002	Lynn	1,077	413	50.5	50.6
250092063001	Lynn	712	250	50.4	50.9

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB

US Census 2010 Block Group					
Block ID	Neighborhood	Population	Housing Units	Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
250092063003	**Lynn**	**1,030**	**379**	**50.0**	**49.9**
250092051001	Lynn	1,192	534	49.9	50.5
250173412003	Malden	1,070	451	53.0	53.4
250173412004	Malden	978	383	52.9	53.0
250173412005	Malden	1,693	713	51.7	51.9
250173414005	Malden	769	389	51.1	52.1
250173412006	Malden	976	362	50.9	50.8
250173412002	Malden	976	386	50.4	50.5
250173398011	Medford	2,101	1,369	56.9	56.1
250173398012	Medford	617	263	56.2	56.2
250173398013	Medford	808	375	55.8	55.9
250173398021	Medford	1,308	586	55.4	56.0
250173398014	Medford	884	363	54.9	54.8
250173398022	Medford	2,498	1,096	54.7	54.9
250173397003	Medford	785	357	54.3	54.3
250173397001	Medford	552	280	54.0	54.9
250173397002	Medford	1,678	670	53.9	54.1
250173398023	Medford	751	294	53.8	53.9
250173396002	Medford	813	371	53.8	53.7
250173396003	Medford	757	369	53.5	53.6
250173396001	Medford	797	392	53.5	53.5
250173397004	Medford	863	377	53.5	53.4
250173396004	Medford	827	363	53.4	53.5
250173399002	Medford	950	380	53.4	53.3
250173399001	Medford	1,651	719	53.3	53.6
250173396005	Medford	885	377	53.1	53.1
250173399004	Medford	759	346	53.0	53.1
250173396006	Medford	945	443	52.8	52.8
250173395002	Medford	1,312	547	52.8	52.9
250173399003	Medford	939	425	52.5	52.5
250173399005	Medford	872	342	52.5	52.5
250173400003	Medford	713	303	52.4	52.4
250173400001	Medford	1,033	435	52.0	52.0
250173391003	Medford	1,169	691	51.9	52.2
250173400002	Medford	848	376	51.9	51.8

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250173401004	Medford	1,483	609	51.7	51.9
250173391002	Medford	1,460	603	51.5	51.5
250173395004	Medford	736	307	51.4	51.6
250173395003	Medford	641	283	51.2	51.1
250173395001	Medford	1,810	553	51.2	51.8
250173401006	Medford	826	310	51.0	51.1
250173391004	Medford	1,797	1,041	50.9	51.4
250173391005	Medford	1,216	446	49.5	50.1
250173391001	Medford	617	243	48.7	50.6
250214164005	Milton	1,028	348	55.0	55.7
250214164007	Milton	1,002	386	54.5	56.9
250214161012	Milton	1,969	732	53.9	54.7
250214164006	Milton	978	357	53.7	55.7
250214164001	Milton	789	302	53.4	56.0
250214164004	Milton	797	280	50.3	51.3
250214164002	Milton	664	267	49.5	50.8
250092011001	Nahant	629	319	50.1	52.8
250214173002	Quincy	900	630	53.6	57.3
250214173001	Quincy	1,781	1,180	53.5	58.4
250214172001	Quincy	2,743	1,256	52.2	52.3
250214175023	Quincy	887	337	50.7	51.0
250214174001	Quincy	1,125	485	47.5	57.4
250214176021	Quincy**	1,328	585	41.6	50.7
250251708001	Revere	1,815	797	65.1	63.7
250251708004	Revere	977	424	64.5	61.5
250251708002	Revere	1,359	577	64.5	65.5
250251708003	Revere	967	419	63.5	64.3
250251707012	Revere	1,311	622	61.1	62.5
250259815021	Revere	9	3	60.9	57.6
250251705022	Revere	1,684	998	58.8	59.4
250251705021	Revere	1,134	550	58.8	59.0
250251707011	Revere	788	431	57.6	56.7
250251707025	Revere	1,391	553	57.2	56.8
250251707022	Revere	1,474	509	56.8	56.7
250251705012	Revere	1,501	814	55.7	57.5

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250251705011	Revere	1,934	1,112	55.5	57.2
250251707021	Revere	1,146	352	55.4	55.3
250251706012	Revere	1,413	573	55.0	55.6
250251707024	Revere	959	358	54.9	55.0
250251707023	Revere	1,658	547	54.7	54.7
250251706014	Revere	952	380	54.1	54.1
250251706013	Revere	1,387	497	53.9	54.0
250251701003	Revere	773	320	53.5	53.6
250251701007	Revere	1,335	498	53.4	53.5
250251701002	Revere	1,012	384	53.3	53.4
250251706011	Revere	1,351	557	53.0	52.9
250251702002	Revere	1,395	499	52.7	52.8
250251704002	Revere	1,151	506	52.6	52.9
250251704001	Revere	1,102	485	52.6	51.2
250251702001	Revere	1,228	542	52.4	52.5
250251701001	Revere	1,671	769	52.2	53.0
250251701004	Revere	727	290	52.1	52.1
250251703007	Revere	729	300	52.0	52.1
250251704003	Revere	1,097	431	52.0	51.9
250251701005	Revere	1,320	514	51.9	51.9
250251703006	Revere	1,209	517	51.9	51.9
250251704004	Revere	2,025	910	51.4	51.3
250251703005	Revere	1,692	659	51.1	51.2
250251702004	Revere	1,335	533	50.9	50.9
250251702003	Revere	606	240	50.8	50.9
250251703004	Revere	1,609	637	50.7	50.9
250251701006	Revere	722	289	50.4	50.5
250251703003	Revere	946	338	50.0	50.1
250251703002	Revere	899	344	49.9	50.0
250092081021	Saugus	752	301	45.7	56.0
250173501032	Somerville	1,210	520	54.2	54.4
250173504001	Somerville	1,006	368	53.3	53.4
250173501042	Somerville	2,584	947	53.2	53.1
250173504005	Somerville	849	392	53.0	53.1
250173504002	Somerville	1,232	565	52.7	52.6

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				Average DNL from All Census Blocks within the Block Group	DNL at the Centriod Location
Block ID	Neighborhood	Population	Housing Units		
250173501041	Somerville	2,119	793	52.3	52.4
250173503003	Somerville	849	390	52.3	52.4
250173504003	Somerville	1,017	462	52.2	52.2
250173501044	Somerville	1,384	673	52.1	52.2
250173503001	Somerville	965	454	52.1	51.6
250173501043	Somerville	1,188	485	51.7	52.0
250173503002	Somerville	627	304	51.6	51.7
250173502001	Somerville	1,376	586	51.6	51.7
250173504004	Somerville	1,464	721	51.6	51.6
250173502006	Somerville	1,044	502	51.6	51.6
250173510005	Somerville	1,056	484	51.5	51.5
250173514031	Somerville	763	309	51.4	51.4
250173509001	Somerville	803	398	51.4	52.1
250173502005	Somerville	749	315	51.2	51.2
250173514033	Somerville	587	321	51.0	51.0
250173510001	Somerville	1,236	595	51.0	51.0
250173506001	Somerville	117	2	50.9	51.0
250173502004	Somerville	1,410	594	50.9	50.9
250173514032	Somerville	1,017	391	50.9	50.8
250173514035	Somerville	619	288	50.9	50.9
250173514034	Somerville	1,042	369	50.8	50.8
250173502003	Somerville	1,385	533	50.7	50.8
250173511002	Somerville	912	465	50.7	50.7
250173510004	Somerville	1,813	870	50.7	50.6
250173502002	Somerville	603	233	50.7	50.6
250173506004	Somerville	1,164	487	50.7	50.6
250173510006	Somerville	1,018	523	50.6	50.5
250173506002	Somerville	939	371	50.4	50.4
250173505001	Somerville	818	390	50.4	50.2
250173514041	Somerville	1,147	448	50.3	50.3
250173511005	Somerville	1,146	540	50.2	50.3
250173511001	Somerville	1,601	747	50.2	50.2
250173505002	Somerville	811	382	50.2	50.2
250173514042	Somerville	1,335	527	50.2	50.2
250173514043	Somerville	1,026	396	50.1	50.1

Table H-26 2014 DNL Levels for Census Block Group Locations within the DNL 50 dB					
US Census 2010 Block Group				**Average DNL from All Census Blocks within the Block Group**	**DNL at the Centriod Location**
Block ID	**Neighborhood**	**Population**	**Housing Units**		
250173506003	Somerville	733	231	50.0	50.2
250251802004	Winthrop	1,343	549	63.8	65.3
250251802001	Winthrop	1,471	610	61.5	61.7
250251802003	Winthrop	648	336	61.0	61.3
250251804002	Winthrop	839	347	59.9	59.9
250251802002	Winthrop	647	299	59.5	59.4
250251804001	Winthrop	876	435	58.6	58.9
250251801013	Winthrop	2,344	1,194	57.0	57.9
250251801011	Winthrop	1,207	584	55.8	56.0
250251801012	Winthrop	1,215	724	54.4	53.7
250251803014	Winthrop Court Rd	760	297	66.9	67.2
250251803012	Winthrop Court Rd	778	322	63.8	64.0
250251803011	Winthrop Court Rd	652	258	63.1	63.1
250251803013	Winthrop Court Rd	834	351	62.2	62.0
250251805004	Point Shirley Winthrop	882	459	65.8	66.6
250251805002	Point Shirley Winthrop	572	271	64.7	67.7
250251805003	Point Shirley Winthrop	1,156	671	59.6	58.4
250251805001	Point Shirley Winthrop	1,273	613	56.9	57.2

Note:

* Centriod location on the Airport, the Block Group includes area off airport property.

** Centriod location displaced over Quincy Bay

Block group boundaries were modified to only include Land areas.

Noise levels reported do not include aircraft or helicopters not arriving to or departing from Logan Airport.

Only Census Blocks with population were used to compute the average.

Only locations within the 2014 EDR modeling were used.

Bold highlighted Groups Indicate Census Block Group Centorid is below 50dB, while census block centroid average is above 50dB

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massport
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One Harborside Drive
East Boston, MA 02128-2909
Telephone (617) 568-5000
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To: Boston Logan Air Carriers, Chief Pilots

From: Frank Iacovino
Manager, Noise Abatement Office

Date: September 10, 2015

RE: New BOS RNAV Charted Visual Procedure to R33L during the late night period

As a critical user of Boston Logan International Airport, you are aware that a key part of our success is efforts to reduce and minimize our environmental footprint. As a urban airport, being a "good neighbor" to the surrounding communities, provide direct benefits to those impacted by our operations, but also allows us (the airline, the FAA and Massport) to continue to invest on critical infrastructure and technology.

With input from pilots, the FAA and communities, Massport has developed a comprehensive noise mitigation strategy. One crucial component of this strategy is a noise abatement procedure during late night operations, the most sensitive time for our neighbors. Recently, JetBlue published a RNAV Charted Visual approach to Logan's Runway 33L. This special visual approach procedure for Runway 33L was tested by JetBlue during 2014 and has been made public.

Participation of your airlines, as a user of Boston Logan during the late night period, is critical for the success of this procedure. To attain a copy of this procedure, please see the attached link below:

http://fsims.faa.gov/PICResults.aspx?mode=Publication&doctype=Orders

This link will provide airlines with step-by-step instructions to attain the procedure. Please type Order number 7110.79D and hit search.

For additional information please contact William Gianetta FAA Flight Standards District Office via email william.gianetta@faa.gov or telephone 207-780-3263 Ext. 119.

Thank you for your continued support and in working with us to enhance Boston Logan's noise abatement efforts. If you have any questions or would like to discuss any aspect of this letter, please feel free to contact me at 617-561-1841 or Natalie Mohan 617-561-3305.

Sincerely,

Frank Iacovino
Manager, Noise Abatement Office

Cc: William Gianetta (FAA)
Flavio Leo (Massport)

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I

Air Quality/ Emissions Reduction

This appendix provides the following detailed information and data tables in support of *Chapter 7, Air Quality/ Emissions Reduction*:

- Fundamentals of Air Quality
  - Table I-1 National Ambient Air Quality Standards
  - Table I-2 Airport-Related Sources of Air Emissions
  - Table I-3 Attainment, Nonattainment, and Maintenance Areas

- Aircraft Fleet and Operational Data Used in EDMS v5.1.4.1
  - Table I-4 2014 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type
- Ground Service Equipment (GSE)/Alternative Fuels Conversion
  - Table I-5 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)
- Motor Vehicle Emissions
  - Table I-6 MOVES2014 Sample Input File for 2014
  - Table I-7 MOVES2014 Sample Output File for 2014
- Fuel Storage and Handling
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- 1993 – 2009 Emissions Inventories
  - Table I-10 Estimated VOC Emissions (in kg/day) at Logan Airport 1993-2001
  - Table I-11 Estimated VOC Emissions (in kg/day) at Logan Airport 2002-2009
  - Table I-12 Estimated NO_X Emissions (in kg/day) at Logan Airport 1993-2001
  - Table I-13 Estimated NO_X Emissions (in kg/day) at Logan Airport 2002-2009
  - Table I-14 Estimated CO Emissions (in kg/day) at Logan Airport 1993-2001
  - Table I-15 Estimated CO Emissions (in kg/day) at Logan Airport 2002-2009
  - Table I-16 Estimated $PM_{10}/PM_{2.5}$ Emissions (in kg/day) at Logan Airport 2005-2009

- Greenhouse Gas (GHG) Emissions Inventory for 2014
  - Table I-17 Logan Airport Greenhouse Gas (GHG) Inventory Input Data and Information for 2014
  - Table I-18 Greenhouse Gas (GHG) Emission Factors for 2014
  - Table I-19 Greenhouse Gas (GHG) Emissions (MMT CO_2 Eq) for 2014
  - Table I-20 Logan Airport Greenhouse Gas (GHG) Emissions Compared to Massachusetts Totals
  - Table I-21 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO_2eq) at Logan Airport – 2007 through 2014
- Measured NO_2 Concentrations
  - Table I-22 Massport and MassDEP Annual NO_2 Concentration Monitoring Results (μg/m^3)

Fundamentals of Air Quality

This section contains a general summary of air quality and air emissions with a particular emphasis on airport-related emissions where appropriate. This material is intended to supplement and provide background information for the materials contained in *Chapter 7, Air Quality/Emissions Reduction*.

Pollutant Types and Standards

The United States (U.S.) Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for a select group of "criteria air pollutants" designed to protect public health, the environment, and the quality of life from the detrimental effects of air pollution. Listed alphabetically, these pollutants are briefly described below:

- **Carbon monoxide (CO)** is a colorless, odorless, tasteless gas. It may temporarily accumulate, especially in cool, calm weather conditions, when fuel use reaches a peak and CO is chemically most stable due to the low temperatures. CO from natural sources usually dissipates quickly, posing no threat to human health. Transportation sources (e.g., motor vehicles), energy generation, and open burning are among the predominant anthropogenic (i.e., man-made) sources of CO.
- **Lead (Pb)** in the atmosphere is generated from industrial sources including waste oil and solid waste incineration, iron and steel production, lead smelting, and battery and lead manufacturing. The lead content of motor vehicle emissions, which was the major source of lead in the past, has significantly declined with the widespread use of unleaded fuel. Low-lead fuel used in some general aviation (GA) aircraft is still a source of airport-related lead.
- **Nitrogen dioxide (NO_2)**, nitric oxide (NO), and the nitrate radical (NO_3) are collectively called oxides of nitrogen (NO_x). These three compounds are interrelated, often changing from one form to another in chemical reactions, and NO_2 is the compound commonly measured for comparison to the NAAQS. NO_x is generally emitted in the form of NO, which is oxidized to NO_2. The principal man-made source of NO_x is fuel combustion in motor vehicles and power plants – aircraft engines are also a source. Reactions of NO_x with other atmospheric chemicals can lead to formation of ozone (O_3) and acidic precipitation.
- **Ozone (O_3)** is a secondary pollutant, formed from daytime reactions of NO_x and volatile organic compounds (VOCs) in the presence of sunlight. VOCs, which are a subset of hydrocarbons (HC) and have no NAAQS, are released in industrial processes and from evaporation of gasoline and solvents. Sources of NO_x are discussed above.
- **Particulate matter (PM)** comprises very small particles of dirt, dust, soot, or liquid droplets called aerosols. The NAAQS for PM is segregated by sizes (i.e., less than 10 and less than 2.5 microns as PM_{10} and $PM_{2.5}$, respectively). PM is formed as an exhaust product in the internal combustion engine or can be generated from the breakdown and dispersion of other solid materials (e.g., fugitive dust).
- **Sulfur oxides (SO_x)** are primarily composed of sulfur dioxide (SO_2) which is emitted in natural processes and by man-made sources such as combustion of sulfur-containing fuels and sulfuric acid manufacturing.

The NAAQS for these criteria pollutants are subdivided into the Primary Standards (designed to protect human health) and the Secondary Standards (designed to protect the environment and human welfare) and are listed below in Table I-1. Exceedances of these values constitute violations of the NAAQS.

Table I-1 National Ambient Air Quality Standards

Pollutants	Averaging Time	Concentration	Condition of Violation
Ozone (O_3)	8-hour	0.075 ppm	3-year average of the fourth-highest daily maximum 8-hour average.
Carbon Monoxide (CO)	8-hour	9 ppm	No more than once per year.
	1-hour	35 ppm	
Nitrogen Dioxide (NO_2)	Annual Average	53 ppb	Annual mean.
	1-hour	100 ppb	3-year average of the 98th percentile of the daily maximum 1-hour average.
Sulfur Dioxide (SO_2)	3-hour	0.5 ppm	No more than once per year.
	1-hour	75 ppb	Three-year average of the 99th percentile of 1-hour daily maximum concentrations.
Particulate Matter (PM_{10})	24-hour	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years.
Particulate Matter ($PM_{2.5}$)	Annual (primary)	12 $\mu g/m^3$	Annual mean, averaged over 3 years.
	Annual (secondary)	15 $\mu g/m^3$	Annual mean, averaged over 3 years.
	24-hour	35 $\mu g/m^3$	3-year average of the 98th percentile.
Lead (Pb)	Rolling 3 month average	0.15 $\mu g/m^3$	Not to be exceeded.

Source: U.S. EPA, 2015, http://www.epa.gov/air/criteria.html
Note: ppm - parts per million; ppb – parts per billion; $\mu g/m^3$ - micrograms per cubic meter

Sources of Airport Air Emissions

Almost all large metropolitan airports generate air emissions from the following general source categories: aircraft, ground service equipment (GSE), and motor vehicles traveling to, from, and moving about the airport; fuel storage and transfer facilities; a variety of stationary sources (e.g., steam boilers, back-up generators, snow melters, etc.); an assortment of aircraft maintenance activities (e.g., painting, cleaning, repair, etc.); routine airfield, roadway, and building maintenance activities (e.g., painting, cleaning, repair, etc.); and periodic construction activities for new projects or improvements to existing facilities. Table I-2 provides a summary listing of these sources of air emissions, the pollutants, and their characteristics.

Table I-2 Airport-related Sources of Air Emissions

Sources	Emissions	Characteristics
Aircraft	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion that vary depending on aircraft engine type, number of engines, power setting, and period of operation. Emissions are also emitted by an aircraft's auxiliary power unit (APU).
Motor vehicles	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion from patron and employee traffic approaching, departing, and moving about the airport site. Emissions vary depending on vehicle type, distance traveled, operating speed, and ambient conditions.
Ground service equipment	CO NO_2 PM SO_2 VOCs	Exhaust products of fuel combustion from service trucks, tow tugs, belt loaders, and other portable equipment.
Fuel storage and transfer	VOCs	Formed from the evaporation and vapor displacement of fuel from storage tanks and fuel transfer facilities. Emissions vary with fuel usage, type of storage tank, refueling method, fuel type, vapor recovery, climate, and ambient temperature.
Stationary sources	CO NO_2 PM SO_2 VOCs	Exhaust products of fossil fuel combustion from boilers dedicated to indoor heating requirements and emissions from incinerators used for waste reduction. Emissions are generally well controlled with operational techniques and post-burn collection methods. Sources include boilers and hot water generators, emergency generators, incinerators, paint booth and surface coating operations, welding operations, and fire fighting facilities.
Construction Activities	CO NO_2 PM SO_2 VOCs	Construction projects may have associated emissions from dust generated during excavation and land clearing, exhaust emissions from construction equipment and motor vehicles, and evaporative emissions from asphalt paving and painting. The amount of particulate emissions varies with the material type, the amount of area exposed, and meteorology. The construction of airport and airfield improvement projects at airports represents temporary sources of emissions.

Notes: CO - Carbon monoxide; VOC - Volatile organic compounds; PM - Particulate matter; NO_2 - Nitrogen dioxide; SO_2 - Sulfur dioxide.

The U.S. EPA, state, and local air quality agencies maintain outdoor air monitoring networks to measure air quality conditions and gauge compliance with the NAAQS. Based upon the data collected by these agencies, all areas throughout the country are designated by the U.S. EPA with respect to their compliance with the NAAQS. Table I-3 provides the definitions of each of these designations.

Table I-3 Attainment, Nonattainment, and Maintenance Areas

Attainment/Nonattainment Designations			
Attainment	**Attainment/Maintenance**	**Nonattainment Area**	**Unclassifiable**
Any area that meets the NAAQS established for all of the criteria air pollutants.	Any area that is in transition from formerly being a nonattainment area to an attainment area (also called Maintenance).	Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) one or more of the NAAQS.	Any area that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

Source: U.S. EPA

For O_3, CO, PM_{10}, and $PM_{2.5}$, the nonattainment designations are further classified by the severity, or degree, of the violation of the NAAQS. For example, in the case of O_3, these classifications range from highest to lowest as extreme, severe, serious, marginal, and moderate.

The nonattainment designation of an area has a bearing on the emission control measures required and the time periods allotted by which a State Implementation Plan (SIP) must demonstrate attainment of the NAAQS. It is also important to note that the degree of nonattainment determines the thresholds of emissions that are considered to be "*de minimis,*" or levels below (i.e., within) which a formal General Conformity determination is not required.

Finally, the boundaries of nonattainment areas are generally determined based on Core Based Statistical Areas (CBSA) as defined by U.S. census data (air monitoring station locations and contributing emission sources also play a role). However, nonattainment areas for localized pollutants such as lead and CO typically only comprise a partial CBSA or a local "hot-spot." By comparison, regional pollutants such as O_3 can encompass multiple CBSAs and can extend across state lines.

State Implementation Plans (SIP)

For the purposes of this summary explanation of SIPs, it is sufficient to characterize SIPs as the principal instrument by which a state formulates and implements its strategies for bringing nonattainment or maintenance areas into compliance with the NAAQS. In equally broad terms, the SIP contains the necessary emission limitations, control measures and timetables for achieving this objective. Therefore, the SIP development process is delegated to state air quality agencies that may in turn rely on regional, county, and local agencies to help prepare emission inventories that include airport-related emissions.

Aircraft Fleet and Operational Data used in EDMS Version 5.1.4.1

The Federal Aviation Administration (FAA) Emissions Dispersion System (EDMS) is the EPA-preferred and the FAA-required model for conducting airport air quality analyses. The most recent version of EDMS , Version 5.1.4.1 (EDMS v5.1.4.1), was used in support of the 2014 air quality analysis.

Table I-4 contains the data that were used in EDMS v5.1.4.1 to represent actual conditions at Logan Airport in 2014. These data include aircraft type, engine, landing takeoff cycles (LTOs), and taxi times. The aircraft are divided into four categories: air carrier, cargo, commuter, and GA.

Table I-4 2014 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft				
Airbus A310-200 Series	CF6-80C2A2 1862M39	267	AC SATA	24.85
Airbus A319-100 Series	CFM56-5A5	15	AC ACA	24.85
Airbus A319-100 Series	CFM56-5A5	1,776	AC DAL	24.85
Airbus A319-100 Series	V2524-A5	717	AC Spirit	24.85
Airbus A319-100 Series	V2522-A5	1,405	AC UAL	24.85
Airbus A319-100 Series	CFM56-5B6/P	6,306	AC USA	24.85
Airbus A319-100 Series	CFM56-5B6/P	185	AC Virgin America	24.85
Airbus A320-200 Series	CFM56-5-A1	2	AC ACA	24.85
Airbus A320-200 Series	CFM56-5A3	2,439	AC DAL	24.85
Airbus A320-200 Series	V2527-A5	17,117	AC JBU	24.85
Airbus A320-200 Series	V2527-A5	756	AC Spirit	24.85
Airbus A320-200 Series	V2527-A5	2,318	AC UAL	24.85
Airbus A320-200 Series	CFM56-5B4/P	1,365	AC USA	24.85
Airbus A320-200 Series	V2527-A5	1,414	AC Virgin America	24.85
Airbus A321-100 Series	V2533-A5	28	AC AAL	24.85
Airbus A321-100 Series	CFM56-5B3/P	2,709	AC USA	24.85
Airbus A330-200 Series	CF6-80E1A4 Low emissions	275	AC AZA	24.85
Airbus A330-200 Series	PW4168 Talon II	136	AC DAL	24.85
Airbus A330-200 Series	CF6-80E1A2 1862M39	165	AC EIN	24.85
Airbus A330-200 Series	Trent 772 Improved traverse	21	AC USA	24.85
Airbus A330-300 Series	PW4168A Talon II	389	AC DAL	24.85
Airbus A330-300 Series	PW4168A Talon II	115	AC DLH	24.85
Airbus A330-300 Series	CF6-80E1A4 Standard	545	AC EIN	24.85
Airbus A330-300 Series	CF6-80E1A4 Standard	82	AC Iberia	24.85
Airbus A330-300 Series	Trent 772 Improved traverse	177	AC SWR	24.85
Airbus A330-300 Series	Trent 772 Improved traverse	43	AC Turkish Airlines	24.85
Airbus A330-300 Series	PW4168A Talon II	3	AC USA	24.85
Airbus A330-300 Series	Trent 772 Improved traverse	143	AC VIR	24.85
Airbus A340-300 Series	CFM56-5C4/P	237	AC DLH	24.85
Airbus A340-300 Series	CFM56-5C4/P	82	AC Iberia	24.85
Airbus A340-300 Series	CFM56-5C4	184	AC SWR	24.85
Airbus A340-300 Series	CFM56-5C2	182	AC Turkish Airlines	24.85
Airbus A340-300 Series	CFM56-5C4/P	18	AC VIR	24.85
Airbus A340-600 Series	Trent 556-61 Phase5 Tiled	199	AC DLH	24.85
Airbus A340-600 Series	Trent 556-61 Phase5 Tiled	2	AC Iberia	24.85
Airbus A340-600 Series	Trent 556-61 Phase5 Tiled	197	AC VIR	24.85
Boeing 717-200 Series	BR700-715A1-30	1,199	AC DAL	24.85
Boeing 717-200 Series	BR700-715A1-30	1,721	AC TRS	24.85
Boeing 737-300 Series	CFM56-3-B1	70	AC People Express	24.85
Boeing 737-300 Series	CFM56-3-B1	1,825	AC SWA	24.85
Boeing 737-400 Series	CFM56-3B-2	12	AC Miami Air (charter)	24.85
Boeing 737-400 Series	CFM56-3C-1	15	AC People Express	24.85
Boeing 737-400 Series	CFM56-3B-2	41	AC Swift Air (charter)	24.85
Boeing 737-400 Series	CFM56-3B-2	17	AC USA	24.85
Boeing 737-500 Series	CFM56-3-B1	7	AC SWA	24.85

Table I-4 2014 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Boeing 737-700 Series	CFM56-7B24	324	AC Copa	24.85
Boeing 737-700 Series	CFM56-7B26/2	14	AC DAL	24.85
Boeing 737-700 Series	CFM56-7B22	239	AC Sun Country	24.85
Boeing 737-700 Series	CFM56-7B24	7,023	AC SWA	24.85
Boeing 737-700 Series	CFM56-7B24	963	AC UAL	24.85
Boeing 737-800 Series	CFM56-7B26 (8CM051)	8,879	AC AAL	24.85
Boeing 737-800 Series	CFM56-7B24	1,089	AC ASA	24.85
Boeing 737-800 Series	CFM56-7B26 (8CM051)	41	AC Copa	24.85
Boeing 737-800 Series	CFM56-7B26 (8CM051)	2,708	AC DAL	24.85
Boeing 737-800 Series	CFM56-7B26 (8CM051)	12	AC Miami Air (charter)	24.85
Boeing 737-800 Series	CFM56-7B27	275	AC Sun Country	24.85
Boeing 737-800 Series	CFM56-7B26 (8CM051)	407	AC SWA	24.85
Boeing 737-800 Series	CFM56-7B26 (8CM051)	2,604	AC UAL	24.85
Boeing 737-900 Series	CFM56-7B27	456	AC ASA	24.85
Boeing 737-900 Series	CFM56-7B26 (8CM051)	157	AC DAL	24.85
Boeing 737-900 Series	CFM56-7B26 (8CM051)	2,503	AC UAL	24.85
Boeing 747-400 Series	PW4056 Reduced smoke	286	AC AFR	24.85
Boeing 747-400 Series	RB211-524H	641	AC BAW	24.85
Boeing 747-400 Series	CF6-80C2B1F 1862M39	306	AC DLH	24.85
Boeing 747-400 Series	PW4056 Reduced smoke	1	AC UAL	24.85
Boeing 757-200 Series	RB211-535E4B Phase 5	2,370	AC AAL	24.85
Boeing 757-200 Series	PW2037 (4PW072)	1,698	AC DAL	24.85
Boeing 757-200 Series	PW2040 (4PW073)	256	AC EIN	24.85
Boeing 757-200 Series	RB211-535E4 (3RR028)	614	AC ICE	24.85
Boeing 757-200 Series	PW2037 (4PW072)	93	AC TACV-Cabo Verde	24.85
Boeing 757-200 Series	PW2037 (4PW072)	2,052	AC UAL	24.85
Boeing 757-200 Series	RB211-535E4 (3RR028)	10	AC USA	24.85
Boeing 757-300 Series	RB211-535E4B Phase 5	339	AC UAL	24.85
Boeing 767-200 Series	CF6-80A1	7	AC AAL	24.85
Boeing 767-200 Series	CF6-80A	2	AC Swift Air (charter)	24.85
Boeing 767-200 Series	CF6-80C2B2 1862M39	5	AC USA	24.85
Boeing 767-300 Series	CF6-80C2B6 1862M39	14	AC AAL	24.85
Boeing 767-300 Series	CF6-80A2	235	AC DAL	24.85
Boeing 767-300 Series	CF6-80C2B6 1862M39	19	AC Other Charter (domestic)	24.85
Boeing 767-300 Series	PW4060 Reduced smoke	5	AC UAL	24.85
Boeing 767-400 ER	CF6-80C2B7F 1862M39	200	AC DAL	24.85
Boeing 767-400 ER	CF6-80C2B8FA	4	AC UAL	24.85
Boeing 777-200 Series	GE90-90B DAC I	164	AC AFR	24.85
Boeing 777-200 Series	GE90-90B DAC I	696	AC BAW	24.85
Boeing 777-200 Series	GE90-110B1	208	AC Emirates	24.85
Boeing 777-200 Series	GE90-90B DAC II (6GE090)	19	AC Other Charter (international)	24.85
Boeing 777-200 Series	PW4077	5	AC UAL	24.85
Boeing 777-300 ER	GE90-115B	2	AC BAW	24.85
Boeing 777-300 ER	GE90-115B	93	AC Emirates	24.85
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	140	AC Hainan Airlines	24.85
Boeing 787-8 Dreamliner	GEnx-1B64 TAPS (11GE136)	366	AC Japan Airlines JAL	24.85
Boeing MD-82	JT8D-217	9	AC AAL	24.85
Boeing MD-83	JT8D-219 Environmental Kit	6	AC AAL	24.85
Boeing MD-88	JT8D-219 Environmental Kit	927	AC DAL	24.85
Boeing MD-90	V2525-D5	1,450	AC DAL	24.85
Embraer ERJ170	CF34-8E5 LEC (8GE108)	35	AC ACA	24.85

Table I-4 2014 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Air Carrier Aircraft (Cont'd.)				
Embraer ERJ190	CF34-10E5A1 SAC	504	AC ACA	24.85
Embraer ERJ190	CF34-10E6 SAC	24,180	AC JBU	24.85
Embraer ERJ190	CF34-10E6 SAC	7,535	AC USA	24.85
Total Air Carrier Aircraft LTOs		**120,111**		
Cargo Aircraft				
Airbus A300F4-600 Series	CF6-80C2A5F	238	Cargo FDX	24.85
Airbus A300F4-600 Series	PW4158	427	Cargo UPS	24.85
Airbus A310-200 Series	JT9D-7R4E, -7R4E1	6	Cargo FDX	24.85
ATR 42-300	PW120	8	Cargo Mountain Air Cargo	24.85
ATR 72-200	PW127	10	Cargo Mountain Air Cargo	24.85
Boeing 757-200 Series	RB211-535E4 (3RR028)	254	Cargo FDX	24.85
Boeing 757-200 Series	PW2040 (4PW073)	58	Cargo UPS	24.85
Boeing 767-200 Series	CF6-80A	12	Cargo ABX Air	24.85
Boeing 767-200 Series	JT9D-7R4D, -7R4D1	244	Cargo Atlas Air	24.85
Boeing 767-300 ER	CF6-80C2B6F	233	Cargo UPS	24.85
Boeing 767-300 Series	CF6-80C2B6 1862M39	106	Cargo FDX	24.85
Boeing DC-10-10 Series	CF6-6D	561	Cargo FDX	24.85
Boeing MD-11	CF6-80C2D1F 1862M39	480	Cargo FDX	24.85
Bombardier Challenger 300	AE3007A1 Type 2	6	Cargo FDX	24.85
Cessna 208 Caravan	PT6A-114	5	Cargo Mountain Air Cargo	24.85
Cessna 208 Caravan	PT6A-114	207	Cargo Wiggins	24.85
Total Cargo Aircraft LTOs		**2,855**		
Commuter Aircraft				
Bombardier CRJ-100	CF34-3B	1	Comm JZA	24.85
Bombardier CRJ-200	CF34-3B	18	Comm Delta (Pinnacle)	24.85
Bombardier CRJ-200	CF34-3B	8	Comm Expressjet	24.85
Bombardier CRJ-200	CF34-3B	2,363	Comm JZA	24.85
Bombardier CRJ-200	CF34-3B	3,082	Comm USA Express (Air Wisc.)	24.85
Bombardier CRJ-700	CF34-8C1	2	Comm EGF	24.85
Bombardier CRJ-700	CF34-8C1	473	Comm Expressjet	24.85
Bombardier CRJ-700	CF34-8C5 LEC (8GE110)	238	Comm GoJet	24.85
Bombardier CRJ-700	CF34-8C5 LEC (8GE110)	123	Comm JZA	24.85
Bombardier CRJ-700	CF34-8C1	702	Comm Mesa	24.85
Bombardier CRJ-700	CF34-8C5 LEC (8GE110)	125	Comm SkyWest	24.85
Bombardier CRJ-900	CF34-8C5 LEC (8GE110)	3,636	Comm Delta (Pinnacle)	24.85
Bombardier CRJ-900	CF34-8C5 LEC (8GE110)	254	Comm Expressjet	24.85
Bombardier de Havilland Dash 8 Q100	PW120A	595	Comm JZA	24.85
Bombardier de Havilland Dash 8 Q100	PW120A	929	Comm Piedmont	24.85
Bombardier de Havilland Dash 8 Q300	PW123	106	Comm JZA	24.85
Bombardier de Havilland Dash 8 Q400	PW150A	2	Comm JZA	24.85
Bombardier de Havilland Dash 8 Q400	PW150A	2,150	Comm Porter Airlines	24.85
Bombardier de Havilland Dash 8 Q400	PW150A	113	Comm Republic Airlines	24.85
Cessna 402	TIO-540-J2B2	17,540	Comm Hyannis Air Service	24.85
Embraer ERJ135	AE3007A1/3 Type 3	1	Comm EGF	24.85
Embraer ERJ145	AE3007A1E	935	Comm Chautaugua	24.85
Embraer ERJ145	AE3007A1/1 Type 3	1,056	Comm Expressjet	24.85
Embraer ERJ145	AE3007A1E	80	Comm Trans States	24.85
Embraer ERJ170	CF34-8E5 LEC (8GE108)	1,991	Comm Air Canada Express	24.85

Table I-4 2014 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
Commuter Aircraft (Cont'd.)				
Embraer ERJ170	CF34-8E5 LEC (8GE108)	14	Comm Delta (Compass)	24.85
Embraer ERJ170	CF34-8E5 LEC (8GE108)	1,615	Comm Republic Airlines	24.85
Embraer ERJ170	CF34-8E5 LEC (8GE108)	4,875	Comm Shuttle America	24.85
Embraer ERJ170	CF34-8E5 LEC (8GE108)	450	Comm SkyWest	24.85
Embraer ERJ190	CF34-10E6 SAC	30	Comm Republic Airlines	24.85
Saab 340-B-Plus	CT7-9B	2,191	Comm Peninsula Air	24.85
Total Commuter Aircraft LTOs		**45,698**		
General Aviation Aircraft				
Bombardier Challenger 300	AE3007A1 Type 2	455	GA	24.85
Bombardier Challenger 300	AE3007A1 Type 2	194	GA Bombardier Business Jet	24.85
Bombardier Challenger 300	AE3007A1 Type 2	7	GA Delta Air Elite Business Jets	24.85
Bombardier Challenger 300	AE3007A1 Type 2	20	GA Executive Jet	24.85
Bombardier Challenger 300	AE3007A1 Type 2	57	GA Xojet	24.85
Bombardier Challenger 600	CF34-3B	446	GA	24.85
Bombardier Challenger 600	ALF 502L-2	54	GA Bombardier Business Jet	24.85
Bombardier Challenger 600	CF34-3B	15	GA Delta Air Elite Business Jets	24.85
Bombardier Challenger 600	ALF 502L-2	29	GA Executive Jet	24.85
Bombardier CRJ-200	CF34-3B	291	GA	24.85
Bombardier Global Express	BR700-710A2-20	213	GA	24.85
Bombardier Learjet 35	TFE731-2-2B	256	GA	24.85
Bombardier Learjet 40	TFE731-2-2B	116	GA Bombardier Business Jet	24.85
Bombardier Learjet 45	TFE731-2-2B	288	GA	24.85
Bombardier Learjet 45	TFE731-2-2B	34	GA Bombardier Business Jet	24.85
Bombardier Learjet 60	TFE731-2/2A	288	GA	24.85
Bombardier Learjet 60	TFE731-2/2A	12	GA Bombardier Business Jet	24.85
Bombardier Learjet 60	PW306A	9	GA Delta Air Elite Business Jets	24.85
Bombardier Learjet 60	TFE731-2/2A	19	GA Executive Jet	24.85
Bombardier Learjet 60	TFE731-2/2A	6	GA Talon Air	24.85
Cessna 172 Skyhawk	TSIO-360C	30	GA Angel Flight	24.85
Cessna 182	IO-360-B	23	GA Angel Flight	24.85
Cessna 525 CitationJet	JT15D-1 series	7	GA Delta Air Elite Business Jets	24.85
Cessna 525 CitationJet	JT15D-1 series	106	GA Superior Air	24.85
Cessna 550 Citation II	JT15D-4 series (1PW036)	204	GA	24.85
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	345	GA	24.85
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	29	GA Delta Air Elite Business Jets	24.85
Cessna 560 Citation Excel	JT15D-5, -5A, -5B	745	GA Netjets Aviation	24.85
Cessna 560 Citation V	JT15D-5, -5A, -5B	331	GA	24.85
Cessna 560 Citation V	PW530	91	GA Flight Options	24.85
Cessna 560 Citation V	PW530	272	GA Netjets Aviation	24.85
Cessna 680 Citation Sovereign	PW308C	242	GA	24.85
Cessna 680 Citation Sovereign	PW308C	32	GA Executive Jet	24.85
Cessna 680 Citation Sovereign	PW308C	355	GA Netjets Aviation	24.85
Cessna 750 Citation X	AE3007C1 Type 2	11	GA Delta Air Elite Business Jets	24.85
Cessna 750 Citation X	AE3007C Type 2	49	GA Flight Options	24.85
Cessna 750 Citation X	AE3007C Type 2	367	GA Netjets Aviation	24.85
Cessna 750 Citation X	AE3007C Type 2	107	GA Xojet	24.85
Cirrus SR22	TIO-540-J2B2	305	GA	24.85
Cirrus SR22	TIO-540-J2B2	26	GA Angel Flight	24.85
Dassault Falcon 2000	PW308C	570	GA	24.85
Dassault Falcon 2000	PW308C	23	GA Executive Jet	24.85

Table I-4 2014 Fleet Mix, Annual Landing-and-Takeoff Cycles (LTOs), and Taxi/Delay Time-in-Mode by Aircraft Type (Continued)

Aircraft Type	Engine	LTOs	Description (Airline)	Taxi Times
General Aviation Aircraft (Cont'd.)				
Dassault Falcon 2000	PW308C	237	GA Netjets Aviation	24.85
Dassault Falcon 900	TFE731-3	369	GA	24.85
Dassault Falcon 900	TFE731-3	16	GA Executive Jet	24.85
Embraer ERJ135	AE3007A1/3 Type 3	31	GA Flight Options	24.85
Gulfstream G400	TAY Mk611-8	819	GA	24.85
Gulfstream G400	TAY Mk611-8	53	GA Executive Jet	24.85
Gulfstream G400	TAY Mk611-8	152	GA Netjets Aviation	24.85
Gulfstream G400	TAY Mk611-8	7	GA Talon Air	24.85
Gulfstream G500	BR700-710A1-10 (4BR008)	590	GA	24.85
Gulfstream G500	BR700-710A1-10 (4BR008)	29	GA Executive Jet	24.85
Gulfstream G500	BR700-710A1-10 (4BR008)	49	GA Netjets Aviation	24.85
Israel IAI-1126 Galaxy	PW306A	23	GA Executive Jet	24.85
Israel IAI-1126 Galaxy	PW306A	173	GA Netjets Aviation	24.85
Mooney M20-K	TSIO-360C	10	GA Angel Flight	24.85
Pilatus PC-12	PT6A-67B	726	GA PlaneSense	24.85
Piper PA-28 Cherokee Series	O-320	9	GA Angel Flight	24.85
Piper PA-31 Navajo	TIO-540-J2B2	15	GA Angel Flight	24.85
Piper PA-32 Cherokee Six	TIO-540-J2B2	33	GA Angel Flight	24.85
Raytheon Beech Baron 58	TIO-540-J2B2	19	GA Angel Flight	24.85
Raytheon Beech Bonanza 36	TIO-540-J2B2	43	GA Angel Flight	24.85
Raytheon Beechjet 400	JT15D-5, -5A, -5B	719	GA	24.85
Raytheon Beechjet 400	JT15D-5, -5A, -5B	67	GA Flight Options	24.85
Raytheon Beechjet 400	JT15D-5, -5A, -5B	14	GA Talon Air	24.85
Raytheon Hawker 4000 Horizon	PW308A	160	GA Talon Air	24.85
Raytheon Hawker 800	TFE731-3	934	GA	24.85
Raytheon Hawker 800	TFE731-3	14	GA Executive Jet	24.85
Raytheon Hawker 800	TFE731-3	7	GA Flight Options	24.85
Raytheon Hawker 800	TFE731-3	195	GA Netjets Aviation	24.85
Raytheon Hawker 800	TFE731-3	11	GA Talon Air	24.85
Raytheon Super King Air 200	PT6A-42	207	GA	24.85
Raytheon Super King Air 200	PT6A-42	17	GA Talon Air	24.85
Raytheon Super King Air 300	PT6A-60A	371	GA	24.85
Raytheon Super King Air 300	PT6A-60A	18	GA Talon Air	24.85
Rockwell Commander 700	IO-360-B	19	GA Angel Flight	24.85
Total General Aviation Aircraft LTOs		**13,235**		
Total Fleet LTOs		**181,899**		

Source: KBE and Massport.

Notes: Due to rounding of the operations (1 LTO = 2 Operations) there may be some differences (+/-) between the values reported here and those reported in *Chapter 2, Activity Levels.*

Aircraft taxi times are based on Logan Airport data obtained from the FAA Aviation System Performance Metrics (ASPM) database for 2014.

Ground Service Equipment/Alternative Fuels Conversion

For the 2014 analyses, GSE emissions were calculated using EDMS emission factors which are based on the EPA NONROAD2005 model in combination with the GSE time-in-mode survey and the GSE fuel types obtained from the Logan Airport Vehicle Aerodrome Permit Application as part of the *2011 ESPR*. In this way, the most up-to-date GSE fleet operational, conversion, and emissions characteristics are used.

Table I-5 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emissions with Reduction
2000	Volatile Organic Compounds (VOCs)	13.72%	178	24	154
	Oxides of Nitrogen (NO_x)	9.87%	369	36	333
	Carbon Monoxide (CO)	12.88%	6,124	789	5,335
2001	VOCs	13.72%	166	23	143
	NO_x	9.87%	338	33	305
	CO	12.88%	5,960	768	5,193
2002	VOCs	13.6%	286	39	247
	NO_x	8.0%	350	28	322
	CO	16.3%	6,174	1,004	5,170
2003	VOCs	13.8%	263	36	227
	NO_x	8.0%	316	25	291
	CO	16.4%	5,692	934	4,758
2004	VOCs	11.9%	212	25	187
	NO_x	6.6%	357	24	333
	CO	15.4%	4,236	650	3,586
2005	VOCs	12.2%	203	25	178
	NO_x	6.9%	335	23	312
	CO	15.4%	4,175	643	3,531
	$PM_{10}/PM_{2.5}$	9.9%	11	1	10
2006	VOCs	10.7%	86	9	77
	NO_x	7.5%	324	24	300
	CO	13.8%	1,841	255	1,586
	$PM_{10}/PM_{2.5}$	10.8%	10	1	9
2007	VOCs	8.2%	85	7	78
	NO_x	5.1%	315	16	299
	CO	10.4%	2,124	220	1,904
	$PM_{10}/PM_{2.5}$	5.9%	10	<1	10
2008	VOCs	8.3%	72	6	66
	NO_x	4.8%	270	13	257
	CO	10.2%	1,792	183	1,609
	$PM_{10}/PM_{2.5}$	5.6%	16	<1	15
2009	VOCs	8.2%	61	5	56
	NO_x	4.8%	230	11	219
	CO	10.0%	1,516	152	1,364
	$PM_{10}/PM_{2.5}$	3.5%	14	<1	14

Table I-5 Ground Service Equipment Alternative Fuel Conversion Summary (kg/day) (Continued)

Year	Pollutant	Percent Reduction	Calculated Emissions without Reduction	Reduction from AFVs	Calculated Emissions with Reduction
2010	VOCs	7.5%	53	4	49
	NO_x	3.9%	206	8	198
	CO	8.5%	1,335	113	1,222
	$PM_{10}/PM_{2.5}$	2.5%	13	<1	13
2011	VOCs	13.2%	38	5	33
	NO_x	7.5%	188	14	173
	CO	16.7%	834	139	694
	$PM_{10}/PM_{2.5}$	5.5%	14	1	13
2012	VOCs	11.8%	34	4	30
	NO_x	6.8%	176	12	164
	CO	16.3%	738	120	618
	$PM_{10}/PM_{2.5}$	4.9%	13	<1	13
2013	VOCs	10.3%	29	3	26
	NO_x	6.5%	155	10	145
	CO	15.9%	634	101	533
	$PM_{10}/PM_{2.5}$	5.0%	12	<1	12
2014	VOCs	11.5%	26	3	23
	NO_x	5.6%	142	8	134
	CO	15.4%	572	88	484
	$PM_{10}/PM_{2.5}$	4.8%	12	<1	12

Source: KBE and Massport.
Notes: 2000 and 2001 analyses used EDMS v4.03. 2002 and 2003 analyses used EDMS v4.11, which used updated emission factors from the NONROAD2002 Model. 2004 analyses used EDMS v4.21, which again used emission factors from the EPA NONROAD2002 Model. 2005 analysis used EDMS v4.5, which used emission factors from the EPA NONROAD2002 Model. 2006 analysis used EDMS v5.0.1, which used emission factors from the EPA NONROAD2005 Model. 2007 analysis used EDMS v5.0.2, which used emission factors from the EPA NONROAD2005 Model. 2008 analysis used EDMS v5.1, which used emission factors from the EPA NONROAD2005 Model. 2009 analysis used EDMS v5.1.2, which used emission factors from the EPA NONROAD2005 Model. 2010, 2011, and 2012 analysis used EDMS v5.1.3, which used emission factors from the EPA NONROAD2005 Model. 2013 and 2014 used EDMS v5.1.4.1, which used emission factors from the EPA NONROAD2005 Model.

Motor Vehicle Emissions

For the 2014 analysis, the motor vehicle emission factor model MOVES2014 was used. The resultant emission factors were multiplied by average daily vehicle miles to calculate daily emissions. The on-airport traffic data are summarized in the vehicle miles traveled (VMT) analyses of *Appendix G, Ground Access.* Due to the new roadway configuration of the Ted Williams Tunnel, through-traffic no longer traverses Airport property. Therefore, as of 2003, emissions from these vehicles are no longer included as part of the Logan Airport emissions inventory. Further, MOVES2014 was used to obtain vehicle emissions at idle to estimate parking and curbside motor vehicle emissions. Idling emissions are determined for a unit of time and multiplied by total idling time to reach the associated emissions. The input and output files of MOVES2014 are included as Tables I-6 and I-7.

Table I-6 MOVES2014 Sample Input File for 2014

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<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="91" processname="Auxiliary Power Exhaust"/>
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<pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="2" processname="Start Exhaust"/>
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<pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="90" processname="Extended Idle Exhaust"/>
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<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="18" processname="Refueling Displacement Vapor Loss"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="19" processname="Refueling Spillage Loss"/>
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<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="91" processname="Auxiliary Power Exhaust"/>
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<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="2" processname="Start Exhaust"/>
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		<geographicoutputdetail description="LINK"/>
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			<sourceusetype selected="true"/>
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		<outputsho value="true"/>
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</runspec>

Source: KBE and Massport.

Table I-7 MOVES2014 Sample Output Files for 2014

MasterKey	MOVESRunID	iterationID	yearID	monthID	dayID	hourID	stateID	countyID	zoneID	linkID	pollutantID	
	processID	sourceTypeID	regClassId	fuelTypeID	modelYearID	roadTypeID	SCC	emissionQuant		activityTypeID		
	activity	emissionRate	massUnits	distanceUnits								
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	22
	119	NULL	31	0	0	0	0	0	0	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	21
	119	NULL	21	0	0	0	0	0	0	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	19
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	18
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	17
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	16
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	15
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	11
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	10
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	9
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	8
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	7
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											

1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	6
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	5
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	4
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	3
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	2
	119	NULL	31	0	0	0	0	0	0	1	0.851981997	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	1
	119	NULL	21	0	0	0	0	0	0	1	0.952619016	0
	g mi											
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	22
	118	NULL	31	0	0	0	0	0	0.0349911	1	0	
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1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	21
	118	NULL	21	0	0	0	0	0	0.0882532	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
	118	NULL	31	0	0	0	0	0	0.00772099	1	0.851981997	
	0.009062386	g	mi									
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	19
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	0.01038412	g	mi									
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	0.009119324	g	mi									
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	0.010331821	g	mi									
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	118	NULL	31	0	0	0	0	0	0.00805424	1	0.851981997	
	0.009453533	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	15
	118	NULL	21	0	0	0	0	0	0.0101777	1	0.952619016	
	0.010683914	g	mi									
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
	118	NULL	31	0	0	0	0	0	0.0085563	1	0.851981997	
	0.010042818	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
	118	NULL	21	0	0	0	0	0	0.0108502	1	0.952619016	
	0.011389863	g	mi									
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
	118	NULL	31	0	0	0	0	0	0.0092438	1	0.851981997	
	0.01084976	g	mi									

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0.012233117	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	10
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0.012192159	g	mi									
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118	NULL	21	0	0	0	0	0	0.0125229	1	0.952619016	
0.013145759	g	mi									
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118	NULL	31	0	0	0	0	0	0.0135801	1	0.851981997	
0.015939421	g	mi									
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0.017399611	g	mi									
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118	NULL	31	0	0	0	0	0	0.0149146	1	0.851981997	
0.017505769	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	5
118	NULL	21	0	0	0	0	0	0.0189452	1	0.952619016	
0.019887489	g	mi									
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	4
118	NULL	31	0	0	0	0	0	0.0152072	1	0.851981997	
0.017849204	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	3
118	NULL	21	0	0	0	0	0	0.021072101	1	0.952619016	
0.022120177	g	mi									
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	2
118	NULL	31	0	0	0	0	0	0.0160852	1	0.851981997	
0.018879742	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	1
118	NULL	21	0	0	0	0	0	0.0274527	1	0.952619016	
0.028818131	g	mi									
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	22
117	NULL	31	0	0	0	0	0	0	1	0	
NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	21
117	NULL	21	0	0	0	0	0	0	1	0	
NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	20
117	NULL	31	0	0	0	0	0	0.00105666	1	0.851981997	
0.001240237	g	mi									
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	19
117	NULL	21	0	0	0	0	0	0.00117077	1	0.952619016	
0.001229001	g	mi									
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	18
117	NULL	31	0	0	0	0	0	0.00113835	1	0.851981997	
0.00133612	g	mi									
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	17
117	NULL	21	0	0	0	0	0	0.00126127	1	0.952619016	
0.001324003	g	mi									

1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	16
117	NULL	31	0	0	0	0	0	0.00122689	1	0.851981997	
0.001440042	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	15
117	NULL	21	0	0	0	0	0	0.00135939	1	0.952619016	
0.001427003	g	mi									
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	14
117	NULL	31	0	0	0	0	0	0.00132146	1	0.851981997	
0.001551042	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	13
117	NULL	21	0	0	0	0	0	0.00146418	1	0.952619016	
0.001537005	g	mi									
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	12
117	NULL	31	0	0	0	0	0	0.00142379	1	0.851981997	
0.00167115	g	mi									
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	11
117	NULL	21	0	0	0	0	0	0.00157754	1	0.952619016	
0.001656003	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	10
117	NULL	31	0	0	0	0	0	0.00153383	1	0.851981997	
0.001800308	g	mi									
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	9
117	NULL	21	0	0	0	0	0	0.00169947	1	0.952619016	
0.001783998	g	mi									
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	8
117	NULL	31	0	0	0	0	0	0.00165248	1	0.851981997	
0.001939571	g	mi									
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	7
117	NULL	21	0	0	0	0	0	0.00183093	1	0.952619016	
0.001921996	g	mi									
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	6
117	NULL	31	0	0	0	0	0	0.00178057	1	0.851981997	
0.002089915	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	5
117	NULL	21	0	0	0	0	0	0.00197288	1	0.952619016	
0.002071006	g	mi									
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	4
117	NULL	31	0	0	0	0	0	0.00191814	1	0.851981997	
0.002251386	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	3
117	NULL	21	0	0	0	0	0	0.00212529	1	0.952619016	
0.002230997	g	mi									
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	2
117	NULL	31	0	0	0	0	0	0.00206688	1	0.851981997	
0.002425967	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	1
117	NULL	21	0	0	0	0	0	0.0022901	1	0.952619016	
0.002404004	g	mi									
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	22
116	NULL	31	0	0	0	0	0	0	1	0	
NULL	g	mi									

1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	21
	116	NULL	21	0	0	0	0	0	0	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
	116	NULL	31	0	0	0	0	0	0.00177388	1	0.851981997	
	0.002082063	g	mi									
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	19
	116	NULL	21	0	0	0	0	0	0.00122215	1	0.952619016	
	0.001282937	g	mi									
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	18
	116	NULL	31	0	0	0	0	0	0.0027828	1	0.851981997	
	0.003266266	g	mi									
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	17
	116	NULL	21	0	0	0	0	0	0.00188696	1	0.952619016	
	0.001980813	g	mi									
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	16
	116	NULL	31	0	0	0	0	0	0.00389543	1	0.851981997	
	0.004572197	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	15
	116	NULL	21	0	0	0	0	0	0.00262482	1	0.952619016	
	0.002755372	g	mi									
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
	116	NULL	31	0	0	0	0	0	0.00523586	1	0.851981997	
	0.006145506	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
	116	NULL	21	0	0	0	0	0	0.00351699	1	0.952619016	
	0.003691917	g	mi									
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
	116	NULL	31	0	0	0	0	0	0.0070093	1	0.851981997	
	0.008227052	g	mi									
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	11
	116	NULL	21	0	0	0	0	0	0.00470166	1	0.952619016	
	0.004935509	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	10
	116	NULL	31	0	0	0	0	0	0.00928219	1	0.851981997	
	0.01089482	g	mi									
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	9
	116	NULL	21	0	0	0	0	0	0.00624219	1	0.952619016	
	0.006552662	g	mi									
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	8
	116	NULL	31	0	0	0	0	0	0.0104746	1	0.851981997	
	0.012294391	g	mi									
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	7
	116	NULL	21	0	0	0	0	0	0.00710217	1	0.952619016	
	0.007455415	g	mi									
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	6
	116	NULL	31	0	0	0	0	0	0.0124926	1	0.851981997	
	0.014662986	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	5
	116	NULL	21	0	0	0	0	0	0.00846614	1	0.952619016	
	0.008887226	g	mi									

1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	4
	116	NULL	31	0	0	0	0	0	0.016546899	1	0.851981997	
	0.019421654	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	3
	116	NULL	21	0	0	0	0	0	0.0111527	1	0.952619016	
	0.011707408	g	mi									
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	2
	116	NULL	31	0	0	0	0	0	0.028709801	1	0.851981997	
	0.033697661	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	1
	116	NULL	21	0	0	0	0	0	0.019212499	1	0.952619016	
	0.020168083	g	mi									
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	22
	115	NULL	31	0	0	0	0	0	0.00129779	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	21
	115	NULL	21	0	0	0	0	0	0.00327516	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
	115	NULL	31	0	0	0	0	0	0.000286261	1	0.851981997	
	0.000335994	g	mi									
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	19
	115	NULL	21	0	0	0	0	0	0.000365349	1	0.952619016	
	0.000383521	g	mi									
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	18
	115	NULL	31	0	0	0	0	0	0.000288076	1	0.851981997	
	0.000338125	g	mi									
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	17
	115	NULL	21	0	0	0	0	0	0.000363547	1	0.952619016	
	0.000381629	g	mi									
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	16
	115	NULL	31	0	0	0	0	0	0.000298692	1	0.851981997	
	0.000350585	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	15
	115	NULL	21	0	0	0	0	0	0.000375982	1	0.952619016	
	0.000394682	g	mi									
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
	115	NULL	31	0	0	0	0	0	0.000317404	1	0.851981997	
	0.000372548	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
	115	NULL	21	0	0	0	0	0	0.000400881	1	0.952619016	
	0.00042082	g	mi									
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
	115	NULL	31	0	0	0	0	0	0.000342994	1	0.851981997	
	0.000402584	g	mi									
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	11
	115	NULL	21	0	0	0	0	0	0.000430632	1	0.952619016	
	0.000452051	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	10
	115	NULL	31	0	0	0	0	0	0.000385399	1	0.851981997	
	0.000452356	g	mi									

1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	9
115	NULL	21	0	0	0	0	0	0.000462848	1	0.952619016	
0.000485869	g	mi									
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	8
115	NULL	31	0	0	0	0	0	0.000503843	1	0.851981997	
0.000591378	g	mi									
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	7
115	NULL	21	0	0	0	0	0	0.000612419	1	0.952619016	
0.000642879	g	mi									
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	6
115	NULL	31	0	0	0	0	0	0.000553331	1	0.851981997	
0.000649463	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	5
115	NULL	21	0	0	0	0	0	0.000700105	1	0.952619016	
0.000734927	g	mi									
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	4
115	NULL	31	0	0	0	0	0	0.000564136	1	0.851981997	
0.000662145	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	3
115	NULL	21	0	0	0	0	0	0.000779149	1	0.952619016	
0.000817902	g	mi									
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	2
115	NULL	31	0	0	0	0	0	0.000596551	1	0.851981997	
0.000700192	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	1
115	NULL	21	0	0	0	0	0	0.00101628	1	0.952619016	
0.001066827	g	mi									
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	22
112	NULL	31	0	0	0	0	0	0.0059621	1	0	
NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	21
112	NULL	21	0	0	0	0	0	0.015037	1	0	
NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	20
112	NULL	31	0	0	0	0	0	0.00131559	1	0.851981997	
0.001544152	g	mi									
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	19
112	NULL	21	0	0	0	0	0	0.00168578	1	0.952619016	
0.001769627	g	mi									
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	18
112	NULL	31	0	0	0	0	0	0.00132385	1	0.851981997	
0.001553847	g	mi									
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	17
112	NULL	21	0	0	0	0	0	0.00167729	1	0.952619016	
0.001760714	g	mi									
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	16
112	NULL	31	0	0	0	0	0	0.00137236	1	0.851981997	
0.001610785	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	15
112	NULL	21	0	0	0	0	0	0.00173444	1	0.952619016	
0.001820707	g	mi									

1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
	112	NULL	31	0	0	0	0	0	0.00145789	1	0.851981997	
	0.001711175	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
	112	NULL	21	0	0	0	0	0	0.00184904	1	0.952619016	
	0.001941007	g	mi									
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
	112	NULL	31	0	0	0	0	0	0.00157502	1	0.851981997	
	0.001848654	g	mi									
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	11
	112	NULL	21	0	0	0	0	0	0.00198592	1	0.952619016	
	0.002084695	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	10
	112	NULL	31	0	0	0	0	0	0.00176988	1	0.851981997	
	0.002077368	g	mi									
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	9
	112	NULL	21	0	0	0	0	0	0.00213405	1	0.952619016	
	0.002240193	g	mi									
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	8
	112	NULL	31	0	0	0	0	0	0.00231387	1	0.851981997	
	0.002715867	g	mi									
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	7
	112	NULL	21	0	0	0	0	0	0.00282465	1	0.952619016	
	0.002965141	g	mi									
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	6
	112	NULL	31	0	0	0	0	0	0.00254125	1	0.851981997	
	0.002982751	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	5
	112	NULL	21	0	0	0	0	0	0.00322851	1	0.952619016	
	0.003389088	g	mi									
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	4
	112	NULL	31	0	0	0	0	0	0.00259113	1	0.851981997	
	0.003041297	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	3
	112	NULL	21	0	0	0	0	0	0.00359087	1	0.952619016	
	0.003769471	g	mi									
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	2
	112	NULL	31	0	0	0	0	0	0.00274075	1	0.851981997	
	0.003216911	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	1
	112	NULL	21	0	0	0	0	0	0.00467798	1	0.952619016	
	0.004910652	g	mi									
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	22
	110	NULL	31	0	0	0	0	0	0.0409532	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	21
	110	NULL	21	0	0	0	0	0	0.103289999	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
	110	NULL	31	0	0	0	0	0	0.00903658	1	0.851981997	
	0.010606539	g	mi									

1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	19
110	NULL	21	0	0	0	0	0	0.0115779	1	0.952619016	
0.012153757	g	mi									
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	18
110	NULL	31	0	0	0	0	0	0.00909335	1	0.851981997	
0.010673171	g	mi									
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	17
110	NULL	21	0	0	0	0	0	0.0115196	1	0.952619016	
0.012092557	g	mi									
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	16
110	NULL	31	0	0	0	0	0	0.0094266	1	0.851981997	
0.011064319	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	15
110	NULL	21	0	0	0	0	0	0.0119122	1	0.952619016	
0.012504684	g	mi									
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	14
110	NULL	31	0	0	0	0	0	0.0100142	1	0.851981997	
0.011754004	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	13
110	NULL	21	0	0	0	0	0	0.0126993	1	0.952619016	
0.013330933	g	mi									
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	12
110	NULL	31	0	0	0	0	0	0.0108188	1	0.851981997	
0.01269839	g	mi									
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	11
110	NULL	21	0	0	0	0	0	0.0136395	1	0.952619016	
0.014317896	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	10
110	NULL	31	0	0	0	0	0	0.0121573	1	0.851981997	
0.014269432	g	mi									
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	9
110	NULL	21	0	0	0	0	0	0.014657	1	0.952619016	
0.015386004	g	mi									
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	8
110	NULL	31	0	0	0	0	0	0.015893999	1	0.851981997	
0.018655323	g	mi									
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	7
110	NULL	21	0	0	0	0	0	0.019399799	1	0.952619016	
0.020364699	g	mi									
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	6
110	NULL	31	0	0	0	0	0	0.0174558	1	0.851981997	
0.020488461	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	5
110	NULL	21	0	0	0	0	0	0.022173701	1	0.952619016	
0.023276568	g	mi									
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	4
110	NULL	31	0	0	0	0	0	0.0177984	1	0.851981997	
0.020890582	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	3
110	NULL	21	0	0	0	0	0	0.024662999	1	0.952619016	
0.025889678	g	mi									

1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	2
	110	NULL	31	0	0	0	0	0	0.018826	1	0.851981997	
	0.022096711	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	1
	110	NULL	21	0	0	0	0	0	0.0321307	1	0.952619016	
	0.033728803	g	mi									
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	22
	107	NULL	31	0	0	0	0	0	0	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	21
	107	NULL	21	0	0	0	0	0	0	1	0	
	NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
	107	NULL	31	0	0	0	0	0	0.00704443	1	0.851981997	
	0.008268285	g	mi									
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	19
	107	NULL	21	0	0	0	0	0	0.00780517	1	0.952619016	
	0.00819338	g	mi									
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	18
	107	NULL	31	0	0	0	0	0	0.00758907	1	0.851981997	
	0.008907548	g	mi									
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	17
	107	NULL	21	0	0	0	0	0	0.00840849	1	0.952619016	
	0.008826708	g	mi									
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	16
	107	NULL	31	0	0	0	0	0	0.00817928	1	0.851981997	
	0.009600297	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	15
	107	NULL	21	0	0	0	0	0	0.00906263	1	0.952619016	
	0.009513384	g	mi									
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
	107	NULL	31	0	0	0	0	0	0.0088098	1	0.851981997	
	0.01034036	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
	107	NULL	21	0	0	0	0	0	0.00976122	1	0.952619016	
	0.010246719	g	mi									
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
	107	NULL	31	0	0	0	0	0	0.00949199	1	0.851981997	
	0.011141069	g	mi									
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	11
	107	NULL	21	0	0	0	0	0	0.010517	1	0.952619016	
	0.011040091	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	10
	107	NULL	31	0	0	0	0	0	0.0102256	1	0.851981997	
	0.012002131	g	mi									
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	9
	107	NULL	21	0	0	0	0	0	0.0113299	1	0.952619016	
	0.011893422	g	mi									
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	8
	107	NULL	31	0	0	0	0	0	0.0110166	1	0.851981997	
	0.012930555	g	mi									

1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	7
107	NULL	21	0	0	0	0	0	0.0122063	1	0.952619016	
0.012813412	g	mi									
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	6
107	NULL	31	0	0	0	0	0	0.0118705	1	0.851981997	
0.013932806	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	5
107	NULL	21	0	0	0	0	0	0.0131526	1	0.952619016	
0.013806779	g	mi									
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	4
107	NULL	31	0	0	0	0	0	0.0127877	1	0.851981997	
0.015009354	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	3
107	NULL	21	0	0	0	0	0	0.0141687	1	0.952619016	
0.014873417	g	mi									
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	2
107	NULL	31	0	0	0	0	0	0.0137793	1	0.851981997	
0.016173229	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	1
107	NULL	21	0	0	0	0	0	0.0152674	1	0.952619016	
0.016026764	g	mi									
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	22
106	NULL	31	0	0	0	0	0	0	1	0	
NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	21
106	NULL	21	0	0	0	0	0	0	1	0	
NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	20
106	NULL	31	0	0	0	0	0	0.0141911	1	0.851981997	
0.016656573	g	mi									
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	19
106	NULL	21	0	0	0	0	0	0.00977724	1	0.952619016	
0.010263537	g	mi									
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	18
106	NULL	31	0	0	0	0	0	0.0222624	1	0.851981997	
0.02613013	g	mi									
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	17
106	NULL	21	0	0	0	0	0	0.0150957	1	0.952619016	
0.015846523	g	mi									
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	16
106	NULL	31	0	0	0	0	0	0.0311634	1	0.851981997	
0.036577533	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	15
106	NULL	21	0	0	0	0	0	0.020998601	1	0.952619016	
0.022043021	g	mi									
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	14
106	NULL	31	0	0	0	0	0	0.0418869	1	0.851981997	
0.049164067	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	13
106	NULL	21	0	0	0	0	0	0.028135899	1	0.952619016	
0.029535312	g	mi									

1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	12
106	NULL	31	0	0	0	0	0	0.0560744	1	0.851981997	
0.065816414	g	mi									
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	11
106	NULL	21	0	0	0	0	0	0.037613299	1	0.952619016	
0.039484094	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	10
106	NULL	31	0	0	0	0	0	0.0742575	1	0.851981997	
0.087158532	g	mi									
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	9
106	NULL	21	0	0	0	0	0	0.049937502	1	0.952619016	
0.052421273	g	mi									
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	8
106	NULL	31	0	0	0	0	0	0.083796903	1	0.851981997	
0.098355251	g	mi									
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	7
106	NULL	21	0	0	0	0	0	0.056817301	1	0.952619016	
0.059643257	g	mi									
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	6
106	NULL	31	0	0	0	0	0	0.099940903	1	0.851981997	
0.117304009	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	5
106	NULL	21	0	0	0	0	0	0.067729101	1	0.952619016	
0.071097784	g	mi									
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	4
106	NULL	31	0	0	0	0	0	0.132376	1	0.851981997	
0.155374175	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	3
106	NULL	21	0	0	0	0	0	0.089221902	1	0.952619016	
0.093659585	g	mi									
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	2
106	NULL	31	0	0	0	0	0	0.229679003	1	0.851981997	
0.269581991	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	1
106	NULL	21	0	0	0	0	0	0.153699994	1	0.952619016	
0.161344663	g	mi									
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	22
100	NULL	31	0	0	0	0	0	0.0462947	1	0	
NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	21
100	NULL	21	0	0	0	0	0	0.116761997	1	0	
NULL	g	mi									
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	20
100	NULL	31	0	0	0	0	0	0.0102152	1	0.851981997	
0.011989924	g	mi									
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	19
100	NULL	21	0	0	0	0	0	0.013088	1	0.952619016	
0.013738966	g	mi									
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	18
100	NULL	31	0	0	0	0	0	0.0102794	1	0.851981997	
0.012065279	g	mi									

1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	17
100	NULL	21	0	0	0	0	0	0.0130221	1	0.952619016	
0.013669788	g	mi									
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	16
100	NULL	31	0	0	0	0	0	0.0106561	1	0.851981997	
0.012507424	g	mi									
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	15
100	NULL	21	0	0	0	0	0	0.0134659	1	0.952619016	
0.014135662	g	mi									
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	14
100	NULL	31	0	0	0	0	0	0.0113203	1	0.851981997	
0.013287018	g	mi									
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	13
100	NULL	21	0	0	0	0	0	0.0143556	1	0.952619016	
0.015069613	g	mi									
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	12
100	NULL	31	0	0	0	0	0	0.0122299	1	0.851981997	
0.014354646	g	mi									
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	11
100	NULL	21	0	0	0	0	0	0.0154184	1	0.952619016	
0.016185274	g	mi									
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	10
100	NULL	31	0	0	0	0	0	0.013743	1	0.851981997	
0.016130623	g	mi									
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	9
100	NULL	21	0	0	0	0	0	0.0165687	1	0.952619016	
0.017392787	g	mi									
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	8
100	NULL	31	0	0	0	0	0	0.017967001	1	0.851981997	
0.021088474	g	mi									
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	7
100	NULL	21	0	0	0	0	0	0.0219301	1	0.952619016	
0.023020851	g	mi									
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	6
100	NULL	31	0	0	0	0	0	0.0197326	1	0.851981997	
0.023160818	g	mi									
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	5
100	NULL	21	0	0	0	0	0	0.0250658	1	0.952619016	
0.026312513	g	mi									
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	4
100	NULL	31	0	0	0	0	0	0.020119799	1	0.851981997	
0.023615287	g	mi									
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	3
100	NULL	21	0	0	0	0	0	0.0278797	1	0.952619016	
0.029266369	g	mi									
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	2
100	NULL	31	0	0	0	0	0	0.021281499	1	0.851981997	
0.024978813	g	mi									
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	1
100	NULL	21	0	0	0	0	0	0.036321498	1	0.952619016	
0.038128043	g	mi									

1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	22
91	NULL	31	0	0	0	0	0	0.046670325	1	0	NULL	g
mi												
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	21
91	NULL	21	0	0	0	0	0	0.039284363	1	0	NULL	g
mi												
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
91	NULL	31	0	0	0	0	0	0.00456881	1	0.851981997	0.005362566	g
mi												
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	19
91	NULL	21	0	0	0	0	0	0.003710173	1	0.952619016	0.003894708	g
mi												
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	18
91	NULL	31	0	0	0	0	0	0.004652569	1	0.851981997	0.005460877	g
mi												
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	17
91	NULL	21	0	0	0	0	0	0.003790339	1	0.952619016	0.003978862	g
mi												
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	16
91	NULL	31	0	0	0	0	0	0.004763823	1	0.851981997	0.00559146	g
mi												
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	15
91	NULL	21	0	0	0	0	0	0.003906343	1	0.952619016	0.004100635	g
mi												
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
91	NULL	31	0	0	0	0	0	0.004910858	1	0.851981997	0.00576404	g
mi												
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
91	NULL	21	0	0	0	0	0	0.004065064	1	0.952619016	0.004267251	g
mi												
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
91	NULL	31	0	0	0	0	0	0.005166352	1	0.851981997	0.006063921	g
mi												
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	11
91	NULL	21	0	0	0	0	0	0.004313554	1	0.952619016	0.004528099	g
mi												
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	10
91	NULL	31	0	0	0	0	0	0.005783428	1	0.851981997	0.006788204	g
mi												
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	9
91	NULL	21	0	0	0	0	0	0.004822342	1	0.952619016	0.005062193	g
mi												
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	8
91	NULL	31	0	0	0	0	0	0.006437166	1	0.851981997	0.007555518	g
mi												
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	7
91	NULL	21	0	0	0	0	0	0.005417827	1	0.952619016	0.005687296	g
mi												
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	6
91	NULL	31	0	0	0	0	0	0.007430459	1	0.851981997	0.008721381	g
mi												

1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	5
91 NULL 21	0	0	0	0	0	0.006291818	1	0.952619016	0.006604758	g
mi										
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	4
91 NULL 31	0	0	0	0	0	0.009359627	1	0.851981997	0.01098571	g
mi										
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	3
91 NULL 21	0	0	0	0	0	0.007969161	1	0.952619016	0.008365527	g
mi										
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	2
91 NULL 31	0	0	0	0	0	0.015147159	1	0.851981997	0.017778731	g
mi										
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	1
91 NULL 21	0	0	0	0	0	0.013001207	1	0.952619016	0.013647856	g
mi										
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	22
87 NULL 31	0	0	0	0	0	0.872647405	1	0	NULL	g
mi										
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	21
87 NULL 21	0	0	0	0	0	1.148899317	1	0	NULL	g
mi										
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	20
87 NULL 31	0	0	0	0	0	0.076620907	1	0.851981997	0.089932542	g
mi										
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	19
87 NULL 21	0	0	0	0	0	0.083071336	1	0.952619016	0.087203105	g
mi										
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	18
87 NULL 31	0	0	0	0	0	0.079071701	1	0.851981997	0.092809121	g
mi										
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	17
87 NULL 21	0	0	0	0	0	0.085127674	1	0.952619016	0.08936172	g
mi										
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	16
87 NULL 31	0	0	0	0	0	0.082631588	1	0.851981997	0.096987481	g
mi										
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	15
87 NULL 21	0	0	0	0	0	0.08887922	1	0.952619016	0.093299859	g
mi										
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	14
87 NULL 31	0	0	0	0	0	0.087509662	1	0.851981997	0.102713041	g
mi										
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	13
87 NULL 21	0	0	0	0	0	0.094418868	1	0.952619016	0.099115036	g
mi										
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	12
87 NULL 31	0	0	0	0	0	0.093938179	1	0.851981997	0.110258409	g
mi										
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	11
87 NULL 21	0	0	0	0	0	0.101622738	1	0.952619016	0.106677209	g
mi										

1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	10
87 NULL	31	0	0	0	0	0	0.102523491	1	0.851981997	0.120335278	g
mi											
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	9
87 NULL	21	0	0	0	0	0	0.11087092	1	0.952619016	0.116385374	g
mi											
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	8
87 NULL	31	0	0	0	0	0	0.11445646	1	0.851981997	0.134341407	g
mi											
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	7
87 NULL	21	0	0	0	0	0	0.124963917	1	0.952619016	0.131179322	g
mi											
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	6
87 NULL	31	0	0	0	0	0	0.130961746	1	0.851981997	0.153714217	g
mi											
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	5
87 NULL	21	0	0	0	0	0	0.144667283	1	0.952619016	0.151862686	g
mi											
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	4
87 NULL	31	0	0	0	0	0	0.161955908	1	0.851981997	0.19009311	g
mi											
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	3
87 NULL	21	0	0	0	0	0	0.181817725	1	0.952619016	0.190860903	g
mi											
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	2
87 NULL	31	0	0	0	0	0	0.25493893	1	0.851981997	0.299230419	g
mi											
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	1
87 NULL	21	0	0	0	0	0	0.293268859	1	0.952619016	0.307855349	g
mi											
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	22
79 NULL	31	0	0	0	0	0	0.82478869	1	0	NULL	g
mi											
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	21
79 NULL	21	0	0	0	0	0	1.082221508	1	0	NULL	g
mi											
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	20
79 NULL	31	0	0	0	0	0	0.073057733	1	0.851981997	0.085750325	g
mi											
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	19
79 NULL	21	0	0	0	0	0	0.078240208	1	0.952619016	0.082131689	g
mi											
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	18
79 NULL	31	0	0	0	0	0	0.075457253	1	0.851981997	0.088566722	g
mi											
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	17
79 NULL	21	0	0	0	0	0	0.080149218	1	0.952619016	0.084135648	g
mi											
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	16
79 NULL	31	0	0	0	0	0	0.078974403	1	0.851981997	0.09269492	g
mi											

1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	15
79 NULL	21	0	0	0	0	0	0.083712734	1	0.952619016	0.087876405	g
mi											
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	14
79 NULL	31	0	0	0	0	0	0.083810419	1	0.851981997	0.098371115	g
mi											
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	13
79 NULL	21	0	0	0	0	0	0.089008555	1	0.952619016	0.093435627	g
mi											
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	12
79 NULL	31	0	0	0	0	0	0.090141989	1	0.851981997	0.105802692	g
mi											
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	11
79 NULL	21	0	0	0	0	0	0.09587761	1	0.952619016	0.100646332	g
mi											
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	10
79 NULL	31	0	0	0	0	0	0.098405369	1	0.851981997	0.115501699	g
mi											
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	9
79 NULL	21	0	0	0	0	0	0.104620121	1	0.952619016	0.109823675	g
mi											
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	8
79 NULL	31	0	0	0	0	0	0.109912589	1	0.851981997	0.129008112	g
mi											
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	7
79 NULL	21	0	0	0	0	0	0.118045226	1	0.952619016	0.123916512	g
mi											
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	6
79 NULL	31	0	0	0	0	0	0.125646874	1	0.851981997	0.147475973	g
mi											
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	5
79 NULL	21	0	0	0	0	0	0.136663437	1	0.952619016	0.143460748	g
mi											
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	4
79 NULL	31	0	0	0	0	0	0.155062407	1	0.851981997	0.182001976	g
mi											
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	3
79 NULL	21	0	0	0	0	0	0.171659991	1	0.952619016	0.180197947	g
mi											
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	2
79 NULL	31	0	0	0	0	0	0.24330838	1	0.851981997	0.28557925	g
mi											
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	1
79 NULL	21	0	0	0	0	0	0.276649535	1	0.952619016	0.290409419	g
mi											
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	22
31 NULL	31	0	0	0	0	0	0.070541501	1	0	NULL	g
mi											
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00		1	1	2014	1	5	7	25	25025	250250	21
31 NULL	21	0	0	0	0	0	0.059377801	1	0	NULL	g
mi											

1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
31	NULL	31	0	0	0	0	0	0.00690569	1	0.851981997	0.008105441	g
mi												
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	19
31	NULL	21	0	0	0	0	0	0.00560787	1	0.952619016	0.005886792	g
mi												
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	18
31	NULL	31	0	0	0	0	0	0.00703229	1	0.851981997	0.008254036	g
mi												
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	17
31	NULL	21	0	0	0	0	0	0.00572904	1	0.952619016	0.006013989	g
mi												
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	16
31	NULL	31	0	0	0	0	0	0.00720045	1	0.851981997	0.008451411	g
mi												
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	15
31	NULL	21	0	0	0	0	0	0.00590438	1	0.952619016	0.00619805	g
mi												
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
31	NULL	31	0	0	0	0	0	0.0074227	1	0.851981997	0.008712273	g
mi												
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
31	NULL	21	0	0	0	0	0	0.00614428	1	0.952619016	0.006449882	g
mi												
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
31	NULL	31	0	0	0	0	0	0.00780888	1	0.851981997	0.009165546	g
mi												
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	11
31	NULL	21	0	0	0	0	0	0.00651987	1	0.952619016	0.006844153	g
mi												
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	10
31	NULL	31	0	0	0	0	0	0.00874157	1	0.851981997	0.010260275	g
mi												
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	9
31	NULL	21	0	0	0	0	0	0.0072889	1	0.952619016	0.007651433	g
mi												
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	8
31	NULL	31	0	0	0	0	0	0.00972969	1	0.851981997	0.011420065	g
mi												
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	7
31	NULL	21	0	0	0	0	0	0.00818898	1	0.952619016	0.00859628	g
mi												
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	6
31	NULL	31	0	0	0	0	0	0.011231	1	0.851981997	0.013182203	g
mi												
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	5
31	NULL	21	0	0	0	0	0	0.00951	1	0.952619016	0.009983005	g
mi												
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	4
31	NULL	31	0	0	0	0	0	0.014147	1	0.851981997	0.016604811	g
mi												

1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	3
31	NULL	21	0	0	0	0	0	0.0120453	1	0.952619016	0.012644404	g
mi												
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	2
31	NULL	31	0	0	0	0	0	0.022894699	1	0.851981997	0.02687228	g
mi												
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	1
31	NULL	21	0	0	0	0	0	0.0196511	1	0.952619016	0.020628499	g
mi												
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	22
3	NULL	31	0	0	0	0	0	0.558390379	1	0	NULL	g
mi												
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	21
3	NULL	21	0	0	0	0	0	0.71452558	1	0	NULL	g
mi												
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	20
3	NULL	31	0	0	0	0	0	0.36871174	1	0.851981997	0.432769402	g
mi												
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	19
3	NULL	21	0	0	0	0	0	0.300691038	1	0.952619016	0.315646689	g
mi												
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	18
3	NULL	31	0	0	0	0	0	0.359299362	1	0.851981997	0.421721777	g
mi												
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	17
3	NULL	21	0	0	0	0	0	0.294334769	1	0.952619016	0.308974274	g
mi												
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	16
3	NULL	31	0	0	0	0	0	0.350273997	1	0.851981997	0.411128401	g
mi												
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	15
3	NULL	21	0	0	0	0	0	0.294197768	1	0.952619016	0.308830459	g
mi												
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	14
3	NULL	31	0	0	0	0	0	0.340330631	1	0.851981997	0.399457537	g
mi												
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	13
3	NULL	21	0	0	0	0	0	0.298757941	1	0.952619016	0.313617444	g
mi												
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	12
3	NULL	31	0	0	0	0	0	0.334090352	1	0.851981997	0.392133112	g
mi												
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	11
3	NULL	21	0	0	0	0	0	0.308412343	1	0.952619016	0.323752033	g
mi												
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	10
3	NULL	31	0	0	0	0	0	0.356348246	1	0.851981997	0.418257953	g
mi												
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00			1	1	2014	1	5	7	25	25025	250250	9
3	NULL	21	0	0	0	0	0	0.336796463	1	0.952619016	0.35354791	g
mi												

1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	8	3	NULL	31	0	0	0	0	0	0.363296539	1	0.851981997	0.426413398	g	mi
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	7	3	NULL	21	0	0	0	0	0	0.351820081	1	0.952619016	0.369318768	g	mi
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	6	3	NULL	31	0	0	0	0	0	0.373091936	1	0.851981997	0.437910586	g	mi
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	5	3	NULL	21	0	0	0	0	0	0.365177602	1	0.952619016	0.383340659	g	mi
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	4	3	NULL	31	0	0	0	0	0	0.391618669	1	0.851981997	0.459656038	g	mi
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	3	3	NULL	21	0	0	0	0	0	0.384929419	1	0.952619016	0.404074884	g	mi
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	2	3	NULL	31	0	0	0	0	0	0.447199881	1	0.851981997	0.52489358	g	mi
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	1	3	NULL	21	0	0	0	0	0	0.444185764	1	0.952619016	0.466278498	g	mi
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	22	2	NULL	31	0	0	0	0	0	17.19623756	1	0	NULL	g	mi
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	21	2	NULL	21	0	0	0	0	0	8.406899452	1	0	NULL	g	mi
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	20	2	NULL	31	0	0	0	0	0	1.867800713	1	0.851981997	2.19230068	g	mi
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	19	2	NULL	21	0	0	0	0	0	1.503711581	1	0.952619016	1.578502587	g	mi
1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	18	2	NULL	31	0	0	0	0	0	1.864228964	1	0.851981997	2.188108398	g	mi
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	17	2	NULL	21	0	0	0	0	0	1.519069552	1	0.952619016	1.594624427	g	mi
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	16	2	NULL	31	0	0	0	0	0	1.920638204	1	0.851981997	2.254317825	g	mi
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	15	2	NULL	21	0	0	0	0	0	1.60879612	1	0.952619016	1.688813778	g	mi
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	14	2	NULL	31	0	0	0	0	0	2.0300951	1	0.851981997	2.382791076	g	mi

1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	13	2	NULL	21	0	0	0	0	0	1.766948342	1	0.952619016	1.854832113	g	mi
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	12	2	NULL	31	0	0	0	0	0	2.158792019	1	0.851981997	2.533846989	g	mi
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	11	2	NULL	21	0	0	0	0	0	1.940628648	1	0.952619016	2.03715086	g	mi
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	10	2	NULL	31	0	0	0	0	0	2.275952816	1	0.851981997	2.671362567	g	mi
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	9	2	NULL	21	0	0	0	0	0	2.030775547	1	0.952619016	2.131781449	g	mi
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	8	2	NULL	31	0	0	0	0	0	2.717482328	1	0.851981997	3.189600645	g	mi
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	7	2	NULL	21	0	0	0	0	0	2.477797747	1	0.952619016	2.601037461	g	mi
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	6	2	NULL	31	0	0	0	0	0	3.058719873	1	0.851981997	3.590122658	g	mi
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	5	2	NULL	21	0	0	0	0	0	2.813952446	1	0.952619016	2.953911688	g	mi
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	4	2	NULL	31	0	0	0	0	0	3.505972147	1	0.851981997	4.115077733	g	mi
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	3	2	NULL	21	0	0	0	0	0	3.242535114	1	0.952619016	3.40381103	g	mi
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	2	2	NULL	31	0	0	0	0	0	4.847739697	1	0.851981997	5.689955552	g	mi
1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	1	2	NULL	21	0	0	0	0	0	4.52829361	1	0.952619016	4.753520067	g	mi
1,1,2014,1,5,7,25,25025,250250,22,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	22	1	NULL	31	0	0	0	0	0	0.840692699	1	0	NULL	g	mi
1,1,2014,1,5,7,25,25025,250250,21,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	21	1	NULL	21	0	0	0	0	0	1.107412457	1	0	NULL	g	mi
1,1,2014,1,5,7,25,25025,250250,20,31,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	20	1	NULL	31	0	0	0	0	0	0.075618528	1	0.851981997	0.088756016	g	mi
1,1,2014,1,5,7,25,25025,250250,19,21,0,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	19	1	NULL	21	0	0	0	0	0	0.080881208	1	0.952619016	0.084904045	g	mi

1,1,2014,1,5,7,25,25025,250250,18,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	18
	1	NULL	31	0	0	0	0	0	0.07812155	1	0.851981997	0.091693898	g
	mi												
1,1,2014,1,5,7,25,25025,250250,17,21,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	17
	1	NULL	21	0	0	0	0	0	0.082780324	1	0.952619016	0.086897619	g
	mi												
1,1,2014,1,5,7,25,25025,250250,16,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	16
	1	NULL	31	0	0	0	0	0	0.081833899	1	0.851981997	0.096051207	g
	mi												
1,1,2014,1,5,7,25,25025,250250,15,21,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	15
	1	NULL	21	0	0	0	0	0	0.086457632	1	0.952619016	0.090757828	g
	mi												
1,1,2014,1,5,7,25,25025,250250,14,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	14
	1	NULL	31	0	0	0	0	0	0.086961009	1	0.851981997	0.102069068	g
	mi												
1,1,2014,1,5,7,25,25025,250250,13,21,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	13
	1	NULL	21	0	0	0	0	0	0.091976151	1	0.952619016	0.096550824	g
	mi												
1,1,2014,1,5,7,25,25025,250250,12,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	12
	1	NULL	31	0	0	0	0	0	0.093631081	1	0.851981997	0.109897957	g
	mi												
1,1,2014,1,5,7,25,25025,250250,11,21,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	11
	1	NULL	21	0	0	0	0	0	0.099106297	1	0.952619016	0.104035606	g
	mi												
1,1,2014,1,5,7,25,25025,250250,10,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	10
	1	NULL	31	0	0	0	0	0	0.102139272	1	0.851981997	0.119884308	g
	mi												
1,1,2014,1,5,7,25,25025,250250,9,21,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	9
	1	NULL	21	0	0	0	0	0	0.108060725	1	0.952619016	0.113435406	g
	mi												
1,1,2014,1,5,7,25,25025,250250,8,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	8
	1	NULL	31	0	0	0	0	0	0.114066094	1	0.851981997	0.133883221	g
	mi												
1,1,2014,1,5,7,25,25025,250250,7,21,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	7
	1	NULL	21	0	0	0	0	0	0.12202172	1	0.952619016	0.128090787	g
	mi												
1,1,2014,1,5,7,25,25025,250250,6,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	6
	1	NULL	31	0	0	0	0	0	0.130200177	1	0.851981997	0.152820339	g
	mi												
1,1,2014,1,5,7,25,25025,250250,5,21,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	5
	1	NULL	21	0	0	0	0	0	0.141151547	1	0.952619016	0.148172087	g
	mi												
1,1,2014,1,5,7,25,25025,250250,4,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	4
	1	NULL	31	0	0	0	0	0	0.160237208	1	0.851981997	0.188075814	g
	mi												
1,1,2014,1,5,7,25,25025,250250,3,21,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	3
	1	NULL	21	0	0	0	0	0	0.176943779	1	0.952619016	0.185744538	g
	mi												
1,1,2014,1,5,7,25,25025,250250,2,31,0,0,0,0,00				1	1	2014	1	5	7	25	25025	250250	2
	1	NULL	31	0	0	0	0	0	0.250348389	1	0.851981997	0.293842346	g
	mi												

1,1,2014,1,5,7,25,25025,250250,1,21,0,0,0,0,00	1	1	2014	1	5	7	25	25025	250250	1
1 NULL 21	0	0	0	0	0	0.284320533	1	0.952619016	0.298461954	g
mi										

Source: KBE and Massport.

Fuel Storage and Handling

As in previous years, VOC emissions from fuel storage and handling were calculated using methods based on EPA's AP-42[1] document. Calculations account for evaporative emissions from breathing losses, working losses, and spillage from aboveground storage tanks, underground storage tanks, and aircraft refueling. In 2003, additional information became available on the fire training fuel, Tek-Flame®. Emissions of VOCs from this fuel were estimated by EDMS. Table I-8 presents Logan Airport's fuel throughput by category.

Stationary Sources

Stationary sources include the Central Heating and Cooling Plant, emergency generators, snow melters, space heaters, and boilers. Emission factors from EPA's AP-42 or NO_x Reasonably Available Control Technology (RACT) compliance testing were combined with the actual 2014 fuel throughput of the stationary sources to obtain emissions of VOCs, NO_X, CO, and PM with a diameter of less than or equal to 10 micrograms or 2.5 micrograms (PM_{10}/$PM_{2.5}$).

Title V of the 1990 Clean Air Act (CAA) Amendments requires facilities with air emissions to document their emissions and obtain a single permit combining all sources. The permitting program ensures that all emission sources are accounted for, the proper permits have been received, and permit conditions are being followed. A Title V Air Operating Permit covers all of the stationary sources at Logan Airport including boilers, emergency generators, snow melters, fire training, cooling towers, paint booths, deicing facilities, and storage tanks. Table I-9 presents Logan Airport's stationary source fuel throughput by fuel category.

1 Compilation of Air Pollutant Emission Factors, AP-42, Office of Air Quality Planning and Standards, EPA, Fifth Edition, 1995.

Table I-8 Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Jet Fuel	354,095,516	441,901,932	416,748,819	358,190,362	319,439,910	373,996,141	368,645,392	364,450,864	367,585,187	345,631,788	327,358,619	335,693,997	340,421,373	343,731,127	349,397,940	370,222,342
Fire Training Fuel[1]	NA	NA	NA	NA	13,719	12,227	8,105	5,000	8,631	5,971	3,510	800	3,810	2,587	5,400	3,753
Aviation Gas	99,726	90,922	60,691	35,111	32,515	34,717	52,487	35,098	29,067	25,037	18,238	15,268	14,064	12,306	14,422	12,514
Auto Gas	7,200,000	7,569,206	6,181,472	5,754,740	5,436,322	5,803,442	5,903,424	6,028,931	6,022,237	5,693,178	5,736,724	5,696,505	5,487,952	6,694,626	6,800,936	7,007,591
Diesel	768,106	839,751	1,239,904	1,067,847	1,030,185	1,078,665	1,567,688	1,164,493	1,141,335	1,071,707	1,121,241	1,168,761	1,099,720	878,499	1,094,714	1,178,805
Heating Oil No.2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181	303,143	409,049	319,727	384,906	210,794	289,665	289,956
Heating Oil No.6	1,600,893	1,555,527	1,641,693	1,079,283	1,122,975	2,940,752	3,098,126	1,396,529	1,073,260	16,385	368,690	9,010	11,285	6,786	17,721	77,146

Source: Massport, 2014.
1 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2014 it was Tek-Flame®. 2012 includes 100 gallons of avgas, 2013 includes 400 gallons of avgas, and 2014 includes 338 gallons of avgas.
NA Not available.

Table I-9 Stationary Source Fuel Throughput by Fuel Category (gallons)

Fuel Category	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Natural Gas (ft^3)	183,943,000	283,720,049	199,500,000	268,359,282	201,714,114	62,610,000	92,460,000	112,390,000	338,430,000	458,680,000	430,810,000	449,640,000	479,830,000	360,523,000	402,496,000	418,805,000
Heating Oil No. 2	480,733	494,500	582,283	340,492	370,903	381,852	367,899	259,768	423,181	303,143	409,050	319,727	384,906	210,794	289,665	289,956
Heating Oil No. 6	1,600,893	1,555,527	1,641,693	1,079,283	1,122,975	2,940,752	3,098,126	1,396,529	1,073,260	16,385	368,690	9,010	11,285	6,786	17,721	77,146
Diesel Fuel[1]	57,441	NA	NA	NA	NA	67,198	77,848	77,848	258,606	146,718	145,778	116,511	218,081	42,109	231,130	124,480
Fire Training Fuel[2]	23,000	NA	NA	NA	13,719	12,227	8,105	5,000	8,631	5,971	3,510	800	3,810	2,587	5,400	3,753

Source: Massport, 2014.
NA Not available.
1 Diesel fuel was from the stationary snow melter usage. Starting in 2007, portable snow melter usage was also included.
2 Fire Training Fuel used in 1999-2002 was Jet A Fuel while in 2003 through 2014 it was Tek-Flame®. 2012 includes 100 gallons of avgas, 2013 includes 400 gallons of avgas, and 2014 includes 338 gallons of avgas.

1993 Through 2009 Emissions Inventories

Tables I-10 through I-16 contain the 1993 through 2009 Emissions Inventory summary tables for Logan Airport.

Table I-10 Estimated VOC Emissions (in kg/day) at Logan Airport 1993-2001[1]

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)					EDMS v3.22	EDMS v4.21	EDMS v4.03	
Motor Vehicle Model:	MOBILE5a					MOB5a_h	MOB 6.2.03	MOBILE 6.0	
Year:	1993	1994	1995	1996	1997	1998	1999[2]	2000	2001
Aircraft Sources									
Air carriers	1,958	1,554	1,407	1,390	1,227	736	653	514	374
Commuter aircraft	943	543	531	622	498	154	196	140	113
Cargo aircraft	89	244	236	214	207	43	318	207	149
General aviation	51	48	36	24	27	13	141	42	43
Total aircraft sources	3,041	2,389	2,210	2,250	1,959	946	1,308	903	679
Ground Service Equipment[3]	636	533	521	497	530	145	243	153	143
Motor Vehicles									
Ted Williams Tunnel	NA	NA	NA	NA	NA	NA	15		
through-traffic								12	10
Parking/curbside	173	148	127	102	102	118	101	89	77
On-airport vehicles[4]	238	215	179	223	205	258	256	206	170
Total motor vehicle sources	411	363	306	325	307	376	372	307	257
Other Sources									
Fuel storage/handling	408	434	318	356	381	372	352	412	372
Miscellaneous sources[5]	5	5	5	6	6	2	16	2	2
Total other sources	413	439	323	362	387	374	368	414	374
Total Airport Sources	4,501	3,724	3,360	3,434	3,183	1,841	2,291	1,777	1,453

Source: KBE and Massport.
kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emissions inventory include reductions attributable to CNG shuttle buses.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-11 Estimated VOC Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	EDMS v4.11		EDMS v4.21	EDMS v4.5		EDMS v5.0.1		EDMS v5.0.2		EDMS v5.1		EDMS v5.1.2
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	248	208	292	271	227	511	435	381	324	286	237	235
Commuter aircraft	75	95	127	140	125	371	479	409	253	176	131	133
Cargo aircraft	127	94	110	41	19	46	129	112	107	70	71	71
General aviation	52	61	127	147	147	236	226	206	201	171	78	78
Total aircraft sources	502	458	656	599	518	1,164[1]	1,269	1,108	885	703	517	517
Ground Service Equipment[2]	247	227	187	178	167	77	78	78	66	66	56	56
Motor Vehicles												
Ted Williams Tunnel through-traffic	9	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]
Parking/curbside[4]	51	45	38	37	33	33	31	31	25	25	22	22
On-airport vehicles	152	135	129	118	106	106	104	104	82	82	71	71
Total motor vehicle sources	212	180	167	155	139	139	135	135	107	107	93	93
Other Sources												
Fuel storage/handling	329	297	341	340	336	336	338	338	320	320	307	307
Miscellaneous sources[5]	2	3	9	13	8	8	14	14	13	12	7	7
Total other sources	331	300	350	353	344	344	352	352	333	332	314	314
Total Airport Sources	1,292	1,165	1,360	1,285	1,168	1,724	1,834	1,673	1,391	1,208	980	980

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
kg/day kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 The 2006 increase in aircraft VOC emissions is largely attributable to the addition of aircraft main engine startup emissions.
2 GSE emissions include aircraft APUs as well as vehicles and equipment converted to alternative fuels.
3 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
4 Parking/curbside is based on VMT analysis.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-12 Estimated NO_X Emissions (in kg/day) at Logan Airport 1993-2001[1]

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)					EDMS v3.22	EDMS v4.21	EDMS v4.03	
Motor Vehicle Model:	**MOBILE5a**					**MOB5a_h**	**MOB 6.2.03**	**MOBILE 6.0**	
Year:	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999[2]**	**2000**	**2001**
Aircraft Sources									
Air carriers	4,271	4,317	3,861	3,781	4,150	4,471	4,183	4,202	3,707
Commuter aircraft	202	158	192	137	159	203	166	125	233
Cargo aircraft	213	257	332	363	262	254	286	284	267
General aviation	13	13	17	18	21	5	12	49	34
Total aircraft sources	4,699	4,745	4,402	4,299	4,592	4,933	4,647	4,660	4,241
Ground Service Equipment[3]	722	617	607	588	622	317	444	333	305
Motor Vehicles									
Ted Williams Tunnel	NA	NA	NA	NA	NA	NA	28		
through-traffic								26	22
Parking/curbside	25	24	24	24	24	37	39	52	46
On-airport vehicles[4]	240	239	229	257	244	372	449	425	369
Total motor vehicle sources	265	263	253	281	268	409	516	503	437
Other Sources									
Fuel storage/handling	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	278	330	320	275	244	284	165	211	185
Total other sources	278	330	320	275	244	284	165	211	185
Total Airport Sources	5,964	5,955	5,582	5,443	5,726	5,943	5,772	5,707	5,168

Source: KBE and Massport.
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emissions inventory include reductions attributable to CNG shuttle buses.
5 Fuel storage and handling facilities are not sources of Nox emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-13 Estimated NO_X Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	EDMS v4.11		EDMS v4.21	EDMS v4.5		EDMS v5.0.1		EDMS v5.0.2		EDMS v5.1		EDMS v5.1.2
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	2,721	2,479	2,949	2,880	2,849	3,044	3,120	3,121	3,031	3,031	2,944	2,952
Commuter aircraft	208	185	245	225	195	256	353	354	319	319	309	234
Cargo aircraft	246	213	215	211	192	125	248	248	233	233	215	204
General aviation	38	45	49	50	49	60	56	56	43	43	27	23
Total aircraft sources	3,213	2,922	3,458	3,366	3,285	3,485	3,777	3,779	3,626	3,626	3,495	3,413
Ground Service Equipment[2]	322	291	333	312	280	300	299	299	257	257	219	219
Motor Vehicles												
Ted Williams Tunnel through-traffic	20	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[3]	0[3]
Parking/curbside[4]	32	28	21	22	19	19	18	18	15	15	13	13
On-airport vehicles	341	302	267	269	238	238	233	233	182	182	153	153
Total motor vehicle sources	393	330	288	291	257	257	251	251	197	197	166	166
Other Sources												
Fuel storage/handling	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	175	151	211	218	109	109	128	128	124	124	181	181
Total other sources	175	151	211	218	109	109	128	128	124	124	181	181
Total Airport Sources	4,103	3,694	4,290	4,187	3,931	4,151	4,455	4,457	4,204	4,204	4,061	3,979

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
1 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
3 Parking/curbside data is based on VMT analysis.
4 Fuel storage/handling facilities are not a source of NO_x emissions.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-14 Estimated CO Emissions (in kg/day) at Logan Airport 1993-2001[1]

Aircraft/GSE Model:	Logan Dispersion Modeling System (LDMS)					EDMS v3.22	EDMS v4.21	EDMS v4.03	
Motor Vehicle Model:	MOBILE5a					MOB5a_h	MOB 6.2.03	MOBILE 6.0	
Year:	1993	1994	1995	1996	1997	1998	1999[2]	2000	2001
Aircraft Sources									
Air carriers	5,663	4,660	4,691	4,812	4,698	3,079	3,754	2,994	2,475
Commuter aircraft	1,309	927	934	859	770	482	1,404	1,188	1,072
Cargo aircraft	344	572	598	580	514	218	503	400	323
General aviation	353	356	339	549	654	269	940	295	407
Total aircraft sources	7,669	6,515	6,562	6,800	6,636	4,048	6,601	4,877	4,277
Ground Service Equipment[3]	7,482	6,187	6,029	5,740	6,098	5,113	4,532	5,335	5,193
Motor Vehicles									
Ted Williams Tunnel through-traffic	NA	NA	NA	NA	NA	NA	151	133	121
Parking/curbside	952	820	650	644	586	772	437	495	440
On-airport vehicles[4]	1,575	1,451	1,087	1,514	1,283	1,883	2,547	2,245	2,001
Total motor vehicle sources	2,527	2,271	1,737	2,158	1,869	2,655	3,135	2,873	2,562
Other Sources									
Fuel storage/handling	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	26	30	29	39	37	37	168	27	24
Total other sources	26	30	29	39	37	37	168	27	24
Total Airport Sources	17,704	15,003	14,357	14,737	14,640	11,853	14,436	13,112	12,056

Source: KBE and Massport.
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
NA Not available.
MOB MOBILE model for motor vehicle emissions (MOB5a_h=MOBILE5a_h, MOB6.2.03=MOBILE6.2 version .03)
1 The emissions inventory for 1990 is shown in Chapter 7. Emission inventories for 1991 and 1992 were not prepared.
2 Year 1999 emissions were last re-calculated using EDMS v4.21 in the 2004 ESPR Air Quality Analysis.
3 Beginning in 1996 and later, emissions include vehicles and equipment converted to alternative fuels. APU emissions are also included.
4 1999 emission inventory include reductions attributable to CNG shuttle buses.
5 Fuel storage and handling facilities are not sources of CO emissions.
6 Includes the Central Heating and Cooling Plant, emergency electricity generation, and other stationary sources. Fire Training emissions were included in 1999. Diesel snow melter usage was added in 1999.

Table I-15 Estimated CO Emissions (in kg/day) at Logan Airport 2002-2009

Aircraft/GSE Model:	EDMS v4.11		EDMS v4.21	EDMS v4.5		EDMS v5.0.1		EDMS v5.0.2		EDMS v5.1		EDMS v5.1.2
Motor Vehicle Model:	**MOBILE 6.0**	**MOB 6.2.01**	**MOBILE 6.2.03**									
Year:	**2002**	**2003**	**2004**	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources												
Air carriers	2,156	2,128	2,985	2,895	2,828	3,167	2,973	2,973	2,710	2,710	2,460	2,448
Commuter aircraft	783	846	1,010	1,010	950	1,587	2,484	2,484	2,436	2,436	2,364	2,795
Cargo aircraft	285	209	229	174	138	158	241	241	255	255	256	266
General aviation	256	276	416	437	398	442	401	403	345	345	145	150
Total aircraft sources	3,480	3,459	4,640	4,516	4,314	5,354	6,099	6,101	5,746	5,746	5,225	5,659
Ground Service Equipment[2]	5,170	4,758	3,586	3,531	3,409	1,586	1,904	1,904	1,609	1,609	1,364	1,364
Motor Vehicles												
Ted Williams Tunnel through-traffic	112	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[2]	0[3]	0[3]
Parking/curbside[4]	295	253	180	179	144	144	139	139	117	117	107	107
On-airport vehicles	1,872	1,685	1,412	1,290	1,036	1,036	1,038	1,038	834	834	740	740
Total motor vehicle sources	2,279	1,938	1,592	1,469	1,180	1,180	1,177	1,177	951	951	847	847
Other Sources												
Fuel storage/handling	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	23	22	33	40	24	24	51	51	55	55	55	55
Total other sources	23	22	33	40	24	24	51	51	55	55	55	55
Total Airport Sources	10,952	10,177	9,851	9,556	8,927	8,144	9,231	9,233	8,361	8,361	7,491	7,925

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy).
1 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
2 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
3 Parking/curbside information is based on VMT analysis.
4 Fuel storage/handling facilities are not a source of CO emissions.
5 Includes the Central Heating and Cooling Plant, emergency electricity generation, snow melter usage, and other stationary sources.

Table I-16 Estimated PM_{10}/$PM_{2.5}$ Emissions (in kg/day) at Logan Airport, 2005-2009[1]									
Aircraft/GSE Model:	**EDMS v4.5**		**EDMS v5.0.1**		**EDMS v5.0.2**		**EDMS v5.1**		**EDMS v5.1.2**
Motor Vehicle Model:	**MOBILE 6.2.03**								
Year:	**2005**	**2006**		**2007**		**2008**		**2009**	
Aircraft Sources									
Air carriers	25	25	38	35	67	63	42	43	36
Commuter aircraft	1	1	2	6	14	11	6	5	5
Cargo aircraft	2	3	2	3	6	5	4	4	3
General aviation	2	2	2	2	5	5	4	2	2
Total aircraft sources	30	31	44	46	92	84	56	54	46
Ground Service Equipment[2]	11	9	9	10	10	8	15	14	14
Motor Vehicles									
Ted Williams Tunnel through-traffic	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[4]	0[3]	0[3]
Parking/curbside[4]	1	1	1	<1	<1	<1	<1	<1	<1
On-airport vehicles	8	8	8	9	9	7	7	6	6
Total motor vehicle sources	9	9	9	9	9	7	7	6	6
Other Sources									
Fuel storage/handling	0	0	0	0	0	0	0	0	0
Miscellaneous sources[5]	34	16	16	17	17	3	3	5	5
Total other sources	34	16	16	17	17	3	3	5	5
Total Airport Sources	84	65	78	82	128	102	81	79	71

Source: KBE and Massport
Notes: Years 2006 to 2009 were computed with previous years EDMS version to provide for a common basis of comparison.
Kg/day kilograms per day. 1 kg/day is approximately equivalent to 0.40234 tons per year (tpy); PM – particulate matter
1 It is assumed that all PM are less than 2.5 microns in diameter ($PM_{2.5}$).
2 2005 is the first year that PM_{10}/$PM_{2.5}$ emissions were included in the Logan Airport ESPR/EDR emission inventories.
3 GSE emissions include APUs as well as vehicles and equipment converted to alternative fuels.
4 Due to the new roadway configuration and opening of the Ted Williams Tunnel there was no Ted Williams Tunnel through-traffic at Logan Airport beginning in 2003.
5 Parking/curbside is based on VTM analysis.
6 Fuel storage and handling facilities are not sources of PM emissions.
7 Includes the Central Heating and Cooling Plant, emergency electricity generation, fire training, snow melters, and other stationary sources.

Greenhouse Gas Emissions Inventory for 2014

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) has published the *MEPA Greenhouse Gas Emissions Policy and Protocol*.[2] These guidelines require that certain projects undergoing review under the Massachusetts Environmental Policy Act (MEPA) quantify the greenhouse gas (GHG) emissions generated by proposed projects, and identify measures to avoid, minimize, or mitigate such emissions.[3] Even though the *2014 EDR* does not assess any proposed projects and is therefore not subject to the GHG policy, Massport has voluntarily prepared an emission inventory of GHG emissions directly and indirectly associated with Logan Airport.

In April 2009, the Transportation Research Board Airport Cooperative Research Program (ACRP); published the *Guidebook on Preparing Airport Greenhouse Gas Emission Inventories (ACRP Report 11)*, which provides recommended instructions to airport operators on how to prepare an airport-specific GHG emissions inventory.[4] The 2014 GHG emissions estimates include aircraft (within the ground taxi/delay and up to 3,000 feet), GSE, APU, motor vehicles, a variety of stationary sources, and electricity usage. Aircraft cruise emissions over the 3,000-foot level were not included. This work was accomplished following the EEA guidelines and uses widely-accepted emission factors that are considered appropriate for this application, including International Organization for Standardization New England electricity-based values.

Methodology

Airport GHG emissions are calculated in much the same way as criteria pollutants,[5] through the use of input data such as activity levels or material throughput rates (i.e., fuel usage, VMT, electrical consumption) that are applied to appropriate emission factors (i.e., in units of GHG emissions per gallon of fuel).

In this case, the input data were either based on Massport records, or data and information derived from the latest version of the FAA EDMS (EDMS v5.1.4.1). Table I-17 summarizes the data and information used in the 2014 GHG inventory.

Massport will update the GHG Emissions Inventory for Logan Airport annually.

2 Revised *MEPA Greenhouse Gas Emissions Policy and Protocol*, Massachusetts Executive Office of Energy and Environmental Affairs, effective May 10, 2010.
3 These GHGs are comprised primarily of carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), and three groups of fluorinated gases (i.e., sulfur hexafluoride [SF_6], hydrofluorocarbons [HFCs], and perfluorocarbons [PFCs]). GHG emission sources associated with airports are generally limited to CO_2, CH_4, and N_2O.
4 Transportation Research Board, Airport Cooperative Research Panel, ACRP Report 11, Project 02-06, *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories* (in production). See http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf for the full report.
5 Criteria pollutants are pollutants for which there are National Ambient Air Quality Standards (i.e., carbon monoxide, sulfur dioxide, nitrogen dioxide, etc.).

Table I-17 Logan GHG Inventory Input Data and Information

Activity	Fuel Type	Usage	Units	Source
Aircraft				
Aircraft Taxi	Jet A[1]	19,741,374	gallons	EDMS v5.1.4
	AvGas[2]	667	gallons	EDMS v5.1.4
Engine Startup	Jet A	215,235	gallons	EDMS v5.1.4
Aircraft Ground up to 3,000 feet	Jet A[1]	17,354,194	gallons	EDMS v5.1.4
	AvGas[2]	587	gallons	EDMS v5.1.4
Aircraft Support Equipment				
GSE	Diesel	749,053	gallons	Massport
	Gasoline	618,706	gallons	Massport
	Propane	1,710	gallons	EDMS v5.1.4
	CNG	416,275	ft^3	EDMS v5.1.4
APU	Jet A	802,658	gallons	EDMS v5.1.4
Motor Vehicles				
On-airport Vehicles	Composite[3]	57,967,179	VMT	Massport
On-airport Parking/Curbsides	Composite[3]	1,292,000	Idle hours	Massport
Massport Shuttle Bus	CNG	256,595	GEG	Massport
	Diesel	326,342	gallons	Massport
Massport Express Bus	Diesel	343,018	gallons	Massport
Masspoort Fire Rescue	Diesel	20,000	gallons	Massport
Aquircultural Equipment	Diesel	106,821	gallons	Massport
Massport Fleet Vehicles (Honda Civic)	CNG	1,956	GEG	Massport
Massport Fleet Vehicles (Fueled Onsite)	Gasoline	130,931	gallons	Massport
Massport Fleet Vehicles (Fueled Offsite)	Gasoline	83,443	gallons	Massport
Massport Fleet Vehicles (Fueled Onsite)	Diesel	134,868	gallons	Massport
Off-airport Vehicles (Public)	Composite[3]	146,884,278	VMT	Massport
Off-airport Vehicles (Airport Employees)	Composite[3]	2,632,372	VMT	Massport
Off-airport Vehicles (Tenant Employees)	Composite[3]	35,554,640	VMT	Massport
Stationary and Portable Sources				
Boilers and Space Heaters	No 2 Oil	289,956	gallons	Massport
	No 6 Oil	77,146	gallons	Massport
	Natural Gas	416	million ft^3	Massport
Generators	Diesel	61,923	gallons	Massport
Snow melters	ULSD	124,480	gallons	Massport
	CNG	2.6	million ft^3	Massport
Fire Training Facility	Tekflame	3,415	gallons	Massport
	AvGas	338	gallons	Massport
Electrical Consumption – Massport	-	16,221,846	kWh	Massport
Electrical Consumption – Tenent/Common Area	-	168,854,349	kWh	Massport

Sources: Massport and KBE.

Notes: APU – Auxiliary power units; CNG – compressed natural gas; GEG – gasoline equivalent gallons; GSE – ground support equipment; kWh – kilowatt hours; VMT – vehicle miles traveled; ULSD – ultra low sulfur diesel.

1 Jet A density of 6.84 pounds per gallon.

2 AvGas density of 6.0 pounds per gallon.

3 Composite means gasoline, diesel, CNG, and liquefied petroleum gas (LPG) fueled motor vehicles.

Emission factors were obtained from the U.S. Energy Information Administration, the International Panel on Climate Change (IPCC), EPA's MOVES, and the most recent version of EPA's GHG Emission Factors Hub (April 2014).[6,7,8,9] Table I-18 presents emission factors for CO_2, nitrous oxide (N_2O), and methane (CH_4) for 2014.

Table I-18 Greenhouse Gas (GHG) Emission Factors for 2014

Sources	Fuel	CO_2	N_2O	CH_4	Units
Aircraft[1]	Jet A	21.5	0.00066	-[5]	lb/gallon
	AvGas	18.3	0.00024	0.01556	lb/gallon
Ground Support Equipment/ Auxiliary Power Units[1]	Diesel	22.5	0.00057	0.00126	lb/gallon
	Gasoline	19.4	0.00049	0.00110	lb/gallon
	CNG	120.0	0.00023	0.00226	lb/1000 ft^3
	Propane	12.6	0.00011	0.00060	lb/gallon
	Jet A	21.5	0.00066	-[5]	lb/gallon
Motor Vehicles[1,2]	Composite	492	0.00324	0.00473	g/mile
	Composite	4,237	0.04824	0.02283	g/hour
	CNG	120.0	0.00023	0.00226	lb/1000 ft^3
	Diesel	22.5	0.00057	0.00126	lb/gallon
	Gasoline	19.4	0.00049	0.00110	lb/gallon
Stationary and Portable[1]	No. 2 Oil	22.5	0.00018	0.00090	lb/gallon
	No. 6 Oil	24.8	0.00020	0.00099	lb/gallon
	Natural Gas	120.0	0.00023	0.00226	lb/1000 ft^3
	ULSD	22.5	0.00018	0.00090	lb/gallon
Fire Training Facility[1]	Tekflame[3]	12.6	0.00011	0.00060	lb/gallon
	AvGas	18.3	0.00024	0.01556	lb/gallon
Electrical Consumption[4]	-	0.72	0.00001	0.00007	lb/kW-hr

Sources: Massport and KBE.

Notes: CH_4 – methane; CNG – compressed natural gas; CO_2 – carbon dioxide; g- grams; kWh – kilowatt hour; lb – pound; N_2O – nitrous oxides; ULSD – Ultra Low Sulfur Diesel.

1 Environmental Protection Agency, GHG Emissions Factors Hub (April 2014), www.epa.gov/climateleadership/inventory/ghg-emissions.html.

2 Environmental Protection Agency, MOVES2014, http://www.epa.gov/otaq/models/moves/.

3 As propane.

4 Environmental Protection Agency, Emissions & Generation Resource Integrated Database (eGRID) 9th edition Version 1.0, February 2014, http://www.epa.gov/climateleadership/documents/emission-factors.pdf.

5 Contributions of CH_4 emissions from commercial aircraft are reported as zero. Years of scientific measurement campaigns conducted at the exhaust exit plane of commercial aircraft gas turbine engines have repeatedly indicated that CH_4 emissions are consumed over the full emission flight envelope [Reference: Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment, Santoni et al., Environ. Sci. Technol., July 2011, Volume 45, pp. 7075-7082]. As a result, the EPA published that: "*…methane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers*." [Reference: EPA, Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines, May 27, 2009 [EPA-420-R-09-901], http://www.epa.gov/otaq/aviation.htm]. In accordance with the following statements in the 2006 IPCC Guidelines (IPCC 2006), the FAA does not calculate CH_4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "*Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines*." "*Current scientific understanding does not allow other gases (e.g., N_2O and CH_4) to be included in calculation of cruise emissions*." (IPCC 1999).

6 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, 2006, www.ipcc-nggip.iges.or.jp/public/2006gl/index.html.

7 U.S. Energy Information Administration, *Voluntary Reporting of Greenhouse Gases Program. Fuel and Energy Source Codes and Emission Coefficients,* www.eia.doe.gov/oiaf/1605/coefficients.html.

8 U.S. Environmental Protection Agency, GHG Emissions Factors Hub (April 2014), www.epa.gov/climateleadership/inventory/ghg-emissions.html. The most recent version of the Emission Factors Hub includes updates to emission factors for stationary and mobile combustion sources, new electricity emission factors from EPA's Emissions & Generation Resource Integrated Database (eGRID) and the IPCC Fourth and Fifth Assessment Report (AR4/AR5).

9 U.S. Environmental Protection Agency, MOVES Emissions Model, http://www.epa.gov/otaq/models/moves/.

Results

Table I-19 presents the results of the 2014 GHG emissions inventory for Logan Airport by emission source (i.e., aircraft, GSE, motor vehicles, and stationary sources) and compound (i.e., CO_2, N_2O, and CH_4), respectively.

Table I-19 Greenhouse Gas (GHG) Emissions (MMT CO_2 Eq)[1] for 2014

Activity	CO_2	N_2O	CH_4	Total
Aircraft Sources				
Aircraft Taxi	0.19	<0.01	-[2]	0.19
Engine Startup	<0.01	<0.01	<0.01	<0.01
Aircraft AGL to 3,000 feet	0.17	<0.01	<0.01	0.17
Aircraft Support Equipment				
GSE	0.01	<0.01	<0.01	0.01
APU	0.01	<0.01	-[2]	0.01
Motor Vehicles				
On-airport Vehicles	0.03	<0.01	<0.01	0.03
On-airport Parking/Curbsides	0.01	<0.01	<0.01	0.01
Massport Shuttle Buses	0.01	<0.01	<0.01	0.01
Massport Fleet Vehicles	0.01	<0.01	<0.01	0.01
Off-airport Vehicles (Public)	0.05	<0.01	<0.01	0.05
Off-airport Vehicles (Airport Employees)	<0.01	<0.01	<0.01	<0.01
Off-airport Vehicles (Tenant Employees)	0.02	<0.01	<0.01	0.02
Stationary Sources				
Boilers	0.03	<0.01	<0.01	0.03
Generators, Snow melters, etc.	<0.01	<0.01	<0.01	<0.01
Fire Training Facility	<0.01	<0.01	<0.01	<0.01
Electrical Consumption	0.06	<0.01	<0.01	0.06

Sources: Massport and KBE.

1 Units expressed as million metric tons of CO_2 equivalent (MMT CO_2 Eq): 1 metric ton = 1.1 short tons.

2 Contributions of CH_4 emissions from commercial aircraft are reported as zero. Years of scientific measurement campaigns conducted at the exhaust exit plane of commercial aircraft gas turbine engines have repeatedly indicated that CH_4 emissions are consumed over the full emission flight envelope [Reference: Aircraft Emissions of Methane and Nitrous Oxide during the Alternative Aviation Fuel Experiment, Santoni et al., Environ. Sci. Technol., July 2011, Volume 45, pp. 7075-7082]. As a result, the EPA published that: "…methane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers." [Reference: EPA, Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines, May 27, 2009 [EPA-420-R-09-901], http://www.epa.gov/otaq/aviation.htm]. In accordance with the following statements in the 2006 IPCC Guidelines (IPCC 2006), the FAA does not calculate CH_4 emissions for either the domestic or international bunker commercial aircraft jet fuel emissions inventories. "Methane (CH_4) may be emitted by gas turbines during idle and by older technology engines, but recent data suggest that little or no CH_4 is emitted by modern engines." "Current scientific understanding does not allow other gases (e.g., N_2O and CH_4) to be included in calculation of cruise emissions." (IPCC 1999).

Table I-20 compares the total GHG emission from Logan Airport to the total GHG emissions for Massachusetts for the year 2014.

Table I-20 Logan Airport Greenhouse Gas (GHG) Emissions Compared to Massachusetts Totals[1]

	CO_2	N_2O	CH_4	Totals
Logan Airport Emissions (2014)[2]	0.59	<0.01	<0.01	0.60
Massachusetts[3]	82.1	1.3	1.2	84.6
Percent of Logan Airport to Massachusetts[4]	<1%	<1%	<1%	<1%

Sources: Massport and KBE.
1 Units expressed as million metric tons of CO_2 equivalents (MMT CO_2 Eq): 1 metric ton = 1.1 short tons.
2 Total from Massport, tenants, and public categories.
3 Climate Analysis Indicators Tool (CAIT US) Version 4.0. (Washington, DC: World Resources Institute, 2010)
4 Percentages represent the relative amount Logan-related emissions compared to the state totals.

Table I-21 provides a comparison between Airport-related GHG emissions from 2007 through 2014. Total GHG emissions in 2014 were slightly higher (7.1 percent) than 2010 levels. To equally compare to previous years, the 2014 emissions are summarized in a manner similar to previous years.

Table I-21 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MMT of CO_2eq) at Logan Airport – 2007 through 2014

Source	2007	2008	2009	2010	2011	2012	2013	2014
Direct Emissions[2]								
Aircraft[3]	0.22	0.21	0.19	0.18	0.19	0.19	0.19	0.20
GSE/APUs	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02
Motor vehicles[4]	0.03	0.03	0.03	0.03	0.04	0.03	0.05	0.05
Other sources[5]	0.04	0.03	0.03	0.03	0.03	0.02	0.03	0.03
Total Direct Emissions	0.37	0.35	0.27	0.27	0.28	0.26	0.29	0.29
Indirect Emissions[6]								
Aircraft[7]	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Motor vehicles[8]	0.05	0.05	0.05	0.05	0.06	0.05	0.08	0.07
Electrical consumption[9]	0.09	0.08	0.07	0.07	0.08	0.08	0.06	0.06
Total Indirect Emissions	0.32	0.30	0.29	0.29	0.30	0.30	0.31	0.30
Total Emissions[10]	0.69	0.65	0.56	0.56	0.58	0.57	0.60	0.60
Percent of State Totals[11]	<1	<1	<1	<1	<1	<1	<1	<1

Sources: Massport and KBE.
1 MMT – million metric tons of CO_2 equivalents (1 MMT = 1.1M Short Tons). CO_2 equivalents (CO_2eq) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.
2 Direct emissions are those that occur in areas located within the Airport's geographic boundaries.
3 Direct aircraft emissions based engine start-up, taxi-in, taxi-out and ground-based delay emissions.
4 Direct motor vehicle emissions based on on-site vehicle miles traveled (VMT).
5 Other sources include Central Heating and Cooling Plant, emergency generators, snow melters and live fire training facility.
6 Indirect emissions are those that occur off the Airport site.
7 Indirect aircraft emissions are based on take-off, climb-out and landing emissions which occur up to an altitude of 3,000 ft., the limits of the landing/take-off (LTO) cycle
8 Indirect motor vehicle emissions based on off-site Airport-related VMT and an average round trip distance of approximately 60 miles.
9 Electrical consumption emissions occur off-airport at power generating plants.
10 Total Emissions = Direct +Indirect.
11 Percentage based on relative amount of Airport total of direct emissions to statewide total from World Resources Institute (cait.wri.org).

Measured NO_2 Concentrations

This section presents the results of Massport's long-term ambient (i.e., outdoor) air quality monitoring program for NO_2 – a pollutant associated with aircraft activity and other fuel combustion sources. Between 1982 and 2011, Massport collected NO_2 concentration data at numerous locations both on the Airport and in neighboring residential communities. The purpose of this monitoring program was to track long-term trends in NO_2 levels and to compare the results to the NAAQS for this pollutant. In 2011, Massport determined that the Logan NO_2 Monitoring Program had achieved its objectives with the significant and stable decrease in NO_2 emissions since 1999 and thus discontinued the program in 2011.

When it was operational, this monitoring program used passive diffusion tube technology for a period of one week each month for 12 months of the year at each of the monitoring stations. The samples of NO_2, along with Quality Assurance/Quality Control (QA/QC) samples, were then analyzed in a laboratory.

Table I-22 presents the final year NO_2 monitoring data (i.e., 2011). For comparative purposes, historical data from 1999 are similarly shown in Table I-22. The table also includes NO_2 data collected under a separate effort by MassDEP using continuous monitors at four Boston-area locations.

As shown on Table I-22, the 2011 NO_2 levels were somewhat higher than in 2010. However, this occurrence is consistent with the cyclical trend of the average levels over the past several years[10]. Importantly, there remains a long-term trend of decreasing NO_2 concentrations at both the Massport and MassDEP monitoring sites since 1999. Other notable observations of the 2011 data reveal the following:

- Annual NO_2 concentrations at all Massport and MassDEP monitoring locations were below the annual NO_2 NAAQS of 100 micrograms per cubic meter ($\mu g/m^3$) in 2011.
- The Massport-collected data compare relatively closely with data collected by the MassDEP. The average of all Massport monitoring sites was 29.8 $\mu g/m^3$ compared to 32.3 $\mu g/m^3$ for the four MassDEP Boston-area monitors.
- The highest NO_2 concentrations in 2011 from the Massport program occurred in areas characterized by high levels of motor vehicle traffic (i.e., Main Terminal Area [Site 8] and Maverick Square [Site 12]).

10 Spatial and temporal changes in measured NO_2 levels from year to year are typical and should not be used to define short-term results. Rather, NO_2 levels are better assessed by looking at the trends over several years.

Table I-22 Massport and MassDEP Annual NO_2 Concentration Monitoring Results (μg/m³)

Monitoring Site	Site No.	Year 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Massport Monitoring Sites														
Runway 9	**1**	61.0	58.2	41.6	45.8	33.9	30.1	35.0	31.9	17.3	31.3	32.2	32.3	38.7
Runway 4R	**2**	55.6	44.6	41.4	36.9	32.5	30.9	30.7	29.0	17.2	20.2	19.2	21.9	25.7
Runway 33L	**3**	47.7	42.6	39.4	33.3	30.8	25.4	24.5	26.3	24.2	21.6	16.9	25.0	29.8
Runway 27	**4**	42.9	37.8	35.8	30.3	25.5	24.1	22.7	22.3	16.9	18.3	17.6	19.4	23.3
Runaway 22L	**5**	47.5	39.8	38.2	33.8	27.8	23.7	22.1	24.9	17.1	21.3	20.1	21.9	29.0
Runway 22R	**6**	60.6	59.2	51.6	45.0	32.3	29.7	32.9	25.1	24.8	29.7	27.8	33.1	30.6
Runway 15R	**7**	47.0	43.4	44.3	42.6	40.8	28.7	27.7	28.7	20.5	24.2	23.9	26.7	29.7
Main Terminal Area	**8**	70.8	87.0	80.7	69.3	44.3	44.7	46.2	43.5	29.5	41.7	37.7	43.9	49.0
Webster St., Jeffries Point	**11**	52.4	45.5	43.4	39.1	32.5	28.3	31.3	31.3	22.7	25.2	23.9	27.0	30.1
Maverick Square, E. Bos	**12**	81.2	72.2	68.5	61.3	47.9	46.5	41.4	45.6	36.0	41.3	38.2	42.5	43.5
Bremen St., E. Boston	**13**	59.1	52.6	52.0	46.2	39.1	35.7	37.6	37.1	27.8	30.1	28.6	31.9	35.3
Shore St. E. Boston	**14**	45.7	38.5	38.8	35.0	27.2	24.0	24.9	22.4	18.1	19.7	18.3	20.7	26.7
Orient Heights Yacht Club	**15**	45.1	46.9	47.7	43.1	29.4	25.2	25.5	25.1	19.6	21.1	18.3	22.5	26.7
Bayswater St. E. Boston	**16**	45.2	45.5	48.3	41.2	28.4	22.8	30.4	23.1	18.4	20.2	17.8	21.0	25.9
Annavoy St. E. Boston	**17**	40.8	39.2	44.4	33.7	24.7	21.4	23.3	21.0	18.2	19.6	17.3	20.9	25.8
Pleasant St. Winthrop	**18**	42.0	39.3	37.8	32.3	27.9	22.6	23.4	21.4	17.8	20.2	17.7	20.1	24.4
Court Road, Winthrop	**19**	40.0	36.1	33.8	27.4	24.0	19.2	22.3	21.0	16.3	17.1	16.7	18.4	22.7
Cottage Park Yacht Club	**20**	37.1	50.9	45.9	36.7	22.5	19.1	27.7	21.4	16.3	18.4	17.8	17.8	22.5
Winthrop, Point Shirley	**21**	33.1	37.7	38.6	24.4	22.7	17.4	17.2	20.2	15.7	15.6	14.9	17.5	21.6
Deer Island	**22**	36.3	31.9	33.8	33.1	21.3	17.8	16.9	17.8	13.0	17.0	14.7	16.7	20.7
Runway 4R–9	**23**	42.2	66.0	42.3	33.4	28.6	24.1	27.1	26.3	19.2	22.4	21.2	21.6	26.5
Runway 33L–4R	**24**	44.3	41.7	41.8	33.5	28.1	24.3	22.3	25.7	20.9	25.2	20.0	23.6	26.2
Runway 22R–33L	**25**	62.4	50.3	49.4	42.2	33.8	31.7	29.4	34.5	22.9	25.1	25.3	29.5	34.9
Jeffries Point Park/Marginal St.	**26**	68.6	49.8	45.0	42.0	35.2	30.5	32.5	31.7	24.4	27.0	25.6	28.6	33.1
Harborwalk	**27**	54.3	48.5	47.4	43.5	35.6	35.5	29.3	34.2	24.2	26.1	24.5	28.3	34.9
Logan Athletic Fields	**29**	NA	69.1	67.6	54.9	41.9	40.2	37.5	37.0	24.6	28.8	26.8	30.8	37.8
Brophy Park, Jeffries Point	**30**	NA	48.0	45.2	41.0	36.5	31.2	32.9	31.3	24.8	26.6	24.6	26.8	30.8
Average of all Monitoring Sites		**50.5**	**50.5**	**47.5**	**40.0**	**31.7**	**28.0**	**28.7**	**28.7**	**21.0**	**24.3**	**22.5**	**25.6**	**29.8**
MassDEP Monitoring Sites[1]														
Long Island Road	**A**	20.7	24.4	22.6	22.6	16.9	12.6	13.2	13.2	13.2	13.2	11.3	13.6	13.4
Harrison Avenue	**B**	NA	45.1	47.0	45.1	43.2	37.4	35.8	35.8	37.7	37.7	33.9	32.1	33.1
Kenmore Square	**C**	56.4	54.5	56.8	47.0	47.0	51.7	43.3	43.3	39.6	41.5	37.7	36.0	38.4
East First Street	**D**	39.5	37.6	43.2	39.5	39.5	36.8	33.9	39.6	37.7	30.2	28.3	24.0	25.4

Notes: The NAAQS is 100 μg/m³.
Massport determined that the Logan NO_2 Monitoring Program had achieved its objectives with the significant and stable decrease in NO_2 emissions since 1999 and thus discontinued the program in 2011.

μg/m³ micrograms/cubic meter.
NA Not available.
1 NO_2 monitoring sites operated by the MassDEP.

J

Water Quality/ Environmental Compliance and Management

This appendix provides detailed information in support of *Chapter 8, Water Quality/Environmental Compliance and Management:*

- Table J-1 National Pollutant Discharge Elimination System (NPDES) Permit Stormwater Outfall Monitoring Requirements (2007)
- Table J-2 Logan Airport 2014 Monthly Monitoring Results for First Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-3 Logan Airport 2014 Monthly Monitoring Results for First Quarter — Porter Street Stormwater Outfall
- Table J-4 Logan Airport 2014 Monthly Monitoring Results for Second Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-5 Logan Airport 2014 Monthly Monitoring Results for Second Quarter — Porter Street Stormwater Outfall
- Table J-6 Logan Airport 2014 Monthly Monitoring Results for Third Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-7 Logan Airport 2014 Monthly Monitoring Results for Third Quarter — Porter Street Stormwater Outfall
- Table J-8 Logan Airport 2014 Monthly Monitoring Results for Fourth Quarter — North, West, and Maverick Street Stormwater Outfalls
- Table J-9 Logan Airport 2014 Monthly Monitoring Results for Fourth Quarter — Porter Street Stormwater Outfall
- Table J-10 Logan Airport 2014 Quarterly Wet Weather Monitoring Results — North, West, Maverick Street, and Porter Street Stormwater Outfalls

- Table J-11 Logan Airport 2014 Quarterly Wet Weather Monitoring Results – Northwest and Runway/Perimeter Stormwater Outfalls
- Table J-12 Logan Airport 2014 Wet Weather Deicing Monitoring Results – North, West, Porter Street, and Runway/Perimeter Stormwater Outfalls
- Table J-13 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2014
- Table J-14 Logan Airport Oil and Hazardous Material Spills and Jet Fuel Handling – 1990 to 2014
- Table J-15 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport – 1999 to 2014
- Table J-16 MCP Activities Status of Massport Sites at Logan Airport
- EnviroNews Vol. 40, Issue 1 – March 2014
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Table J-1 NPDES Permit Stormwater Outfall Monitoring Requirements (2007)

	North Outfall 001		West Outfall 002		Maverick Outfall 003	
Monitoring Event	Field Measurement	Laboratory Analysis	Field Measurement	Laboratory Analysis	Field Measurement	Laboratory Analysis
Monthly Dry Weather	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*
Monthly Wet Weather	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*
Quarterly Wet Weather	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene
Deicing Episode (2/Deicing Season)	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	Not Required	Not Required
Whole Effluent Toxicity (1st and 3rd Year Deicing Season)	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Not Required
Treatment System Sampling (Internal Outfalls)[7]	pH Quantity, Gallons	Oil and Grease TSS[1] Benzene[2]	Not Required	Not Required	Not Required	Not Required

Table J-1 NPDES Permit Stormwater Outfall Monitoring Requirements (2007) (Continued)

	Northwest Outfall 005		Porter Outfall 003 (3 upstream locations)		Select Runway/Perimeter Outfalls	
Monitoring Event	Field Measurement	Laboratory Analysis	Field Measurement	Laboratory Analysis	Field Measurement	Laboratory Analysis
Monthly Dry Weather	Not Required	Not Required	Not Required	Oil and Grease TSS[1] Benzene Surfactant Fecal Coliform *Enterococcus*	Not Required	Not Required
Monthly Wet Weather	Not Required	Not Required	pH Flow Rate	Oil and Grease TSS[1] Benzene[2] Surfactant Fecal Coliform *Enterococcus*	Not Required	Not Required
Quarterly Wet Weather	pH Flow Rate[6]	Oil and Grease TSS[1] Benzene[2]	pH Flow Rate[6]	PAHs[3]: - Benzo(a)anthracene - Benzo(a)pyrene - Benzo(b)fluoranthene - Benzo(k)fluoranthene - Chrysene -Dibenzo(a,h)anthracene - Indeno(1,2,3-cd)pyrene - Naphthalene	pH	Oil and Grease TSS[1] Benzene[2]
Deicing Episode (2/Deicing Season)	Not Required	Not Required	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole	Not Required	Ethylene Glycol Propylene Glycol BOD5[4] COD[5] Total Ammonia Nitrogen Nonylphenol Tolytriazole
Whole Effluent Toxicity (1st and 3rd Year Deicing Season)	Not Required	Not Required	Not Required	Menidia beryllina Arbacia punctulata	Not Required	Not Required
Treatment System Sampling (Internal Outfalls)[7]	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required

Source: Massport
Notes: Requirements are from NPDES Permit MA0000787, issued July 31, 2007.
1 TSS - Total Suspended Solids
2 Benzene must be collected with HDPE bailer.
3 PAH - Polycyclic Aromatic Hydrocarbons
4 BOD - Biological Oxygen Demand
5 COD - Chemical Oxygen Demand
6 Flow Rate will be estimated based on measured precipitation and the hydraulic model developed for the Logan Airport drainage system.
7 Outfalls 001D and 001E samples collected by Swissport.

Table J-2 Logan Airport 2014 Monthly Monitoring Results for First Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	1/18/2014	Wet Weather	2.37	0.55	7.94	<4.0	22	<1.0	0.120	960	22	NA
002A – West Outfall	1/18/2014	Wet Weather	9.12	1.95	7.60	<4.0	41	<1.0	0.070	1,800	320	NA
004A – Maverick Street Outfall	1/18/2014	Wet Weather	0.71	0.11	7.61	<4.0	15	<1.0	0.060	45	34	NA
001C – North Outfall	1/27/2014	Dry Weather				<4.0	31	<1.0	0.150	8,200	5,000	2,800
002C – West Outfall	1/27/2014	Dry Weather				<4.0	29	<1.0	0.110	5,200	<10	NA
004C – Maverick Street Outfall	1/27/2014	Dry Weather				<4.0	35	<1.0	0.070	50	30	NA
001A – North Outfall	2/13/2014	Wet Weather	2.53	0.86	6.12	12	87	<1.0	0.300	460	50	NA
002A – West Outfall	2/13/2014	Wet Weather	11.31	2.40	6.21	11	72	<1.0	0.400	2,200	1,400	NA
004A – Maverick Street Outfall	2/13/2014	Wet Weather	1.02	0.15	6.29	<4.0	56	<1.0	0.090	13,000	400	NA
001C – North Outfall	2/11/2014	Dry Weather				<4.0	34	<1.0	0.130	240	240	NA
002C – West Outfall	2/11/2014	Dry Weather				<4.0	32	<1.0	0.070	3,500	110	NA
004C – Maverick Street Outfall	2/11/2014	Dry Weather				<4.0	36	<1.0	<0.050	3,100	680	NA
001A – North Outfall	3/20/2014	Wet Weather	8.72	0.72	7.67	<4.0	18	<1.0	0.310	40	40	NA
002A – West Outfall	3/20/2014	Wet Weather	34.94	2.80	7.22	<4.0	45	<1.0	0.430	2,600	250	NA
004A – Maverick Street Outfall	3/20/2014	Wet Weather	2.08	0.16	7.07	<4.0	7.0	<1.0	0.110	14,000	2,800	NA
001C – North Outfall	3/4/2014	Dry Weather				<4.0	28	<1.0	<0.050	130	70	NA
002C – West Outfall	3/4/2014	Dry Weather				<4.0	35	<1.0	<0.050	30	4,500	NA
004C – Maverick Street Outfall	3/4/2014	Dry Weather				<4.0	11	<1.0	<0.050	640	470	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report	

Source: Massport.

Notes: Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

NA Not Analyzed.

TSS Total Suspended Solids.

Table J-3 Logan Airport 2014 Monthly Monitoring Results for First Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	1/18/2014	Wet Weather	-	-	7.47	<4.0	38	<1.0	0.110	<10	69
003 - Porter Street Outfall 2	1/18/2014	Wet Weather	-	-	8.49	<4.0	13	<1.0	0.090	<10	2.0
003 - Porter Street Outfall 3	1/18/2014	Wet Weather	-	-	8.19	<4.0	10	<1.0	0.070	210	170
003 - Porter Street Outfall Average		Wet Weather	2.08	0.36	8.05	0.0	20	0.0	0.090	5.9	29
003 - Porter Street Outfall 1	1/27/2014	Dry Weather				<4.0	11	<1.0	0.130	<10	10
003 - Porter Street Outfall 2	1/28/2014	Dry Weather				<4.0	18	<1.0	0.230	<10	<10
003 - Porter Street Outfall 3	1/27/2014	Dry Weather				<4.0	160	<1.0	0.170	<10	20
003 - Porter Street Outfall Average		Dry Weather				0.0	63	0.0	0.177	1.0	5.8
003 - Porter Street Outfall 1	2/13/2014	Wet Weather	-	-	6.90	22	310	<1.0	0.270	<10	130
003 - Porter Street Outfall 2	2/13/2014	Wet Weather	-	-	6.14	11	130	<1.0	0.150	<10	10
003 - Porter Street Outfall 3	2/13/2014	Wet Weather	-	-	6.50	<4.0	30	<1.0	0.130	<10	<10
003 - Porter Street Outfall Average		Wet Weather	3.28	0.46	6.51	11.0	157	0.0	0.183	1.0	11
003 - Porter Street Outfall 1	2/11/2014	Dry Weather				13	250	<1.0	<0.050	10	60
003 - Porter Street Outfall 2	2/11/2014	Dry Weather				<4.0	58	<1.0	0.070	<10	<10
003 - Porter Street Outfall 3	2/11/2014	Dry Weather				<4.0	7.3	<1.0	<0.050	<10	<10
003 - Porter Street Outfall Average		Dry Weather				4.3	105	0.0	0.023	2.2	3.9
003 - Porter Street Outfall 1	3/20/2014	Wet Weather	-	-	7.50	<4.0	10	<1.0	0.200	20	710
003 - Porter Street Outfall 2	3/20/2014	Wet Weather	-	-	7.49	<4.4	12	<1.0	0.140	20	20
003 - Porter Street Outfall 3	3/20/2014	Wet Weather	-	-	7.35	<4.0	6.2	<1.0	0.150	10	40
003 - Porter Street Outfall Average		Wet Weather	7.20	0.48	7.45	0.0	9.4	0.0	0.163	16	83
003 - Porter Street Outfall 1	3/4/2014	Dry Weather				<4.0	<5.0	<1.0	<0.050	<10	<10
003 - Porter Street Outfall 2	3/4/2014	Dry Weather				<4.0	15	<1.0	0.180	<10	<10
003 - Porter Street Outfall 3	3/4/2014	Dry Weather				<4.0	<5.0	<1.0	0.050	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	5.0	0.0	0.077	0.0	0.0
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.

Notes: Flow rates were estimated for outfall 003 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

TSS Total Suspended Solids.

Table J-4 Logan Airport 2014 Monthly Monitoring Results for Second Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	4/15/2014	Wet Weather	3.10	0.69	NM	<4.0	44	<2.0	0.670	17,000	820	13,000
002A – West Outfall	4/15/2014	Wet Weather	12.97	3.13	NM	<4.0	22	<1.0	0.120	90	160	NA
004A – Maverick Street Outfall	4/15/2014	Wet Weather	0.74	0.19	NM	<4.0	130	<1.0	0.170	3,800	900	NA
001C – North Outfall	4/21/2014	Dry Weather				<4.0	26	<1.0	0.080	10	80	NA
002C – West Outfall	4/21/2014	Dry Weather				<4.0	20	<1.0	0.060	40	230	NA
004C – Maverick Street Outfall	4/21/2014	Dry Weather				<4.4	31	<1.0	0.060	25,000	6,700	NA
001A – North Outfall	-	Wet Weather	2.19	0.38	NS	NS	NS	NS	NS	NS	NS	NS
002A – West Outfall	-	Wet Weather	7.95	1.55	NS	NS	NS	NS	NS	NS	NS	NS
004A – Maverick Street Outfall	-	Wet Weather	0.58	0.09	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	5/16/2014	Dry Weather				<4.0	26	<1.0	0.210	46,000	1,300	31,000
002C – West Outfall	5/16/2014	Dry Weather				<4.0	24	<1.0	0.090	3,300	820	NA
004C – Maverick Street Outfall	5/16/2014	Dry Weather				<4.0	30	<1.0	0.080	7,600	1,100	NA
001A – North Outfall	6/4/2014	Wet Weather	2.71	0.34	7.54	<4.0	19	<1.0	0.850	100	410	NA
002A – West Outfall	6/4/2014	Wet Weather	8.40	1.33	7.65	<4.0	11	<1.0	0.190	13,000	3,200	NA
004A – Maverick Street Outfall	6/4/2014	Wet Weather	0.66	0.08	7.18	<4.0	22	<1.0	0.090	2,200	1,700	NA
001C – North Outfall	6/3/2014	Dry Weather				<4.0	11	<1.0	0.230	460	110	NA
002C – West Outfall	6/3/2014	Dry Weather				<4.0	6.4	<1.0	0.140	380	110	NA
004C – Maverick Street Outfall	6/3/2014	Dry Weather				<4.0	25	<1.0	0.100	2,300	450	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report	

Source: Massport.

Notes: Bold values exceed maximum daily discharge limitation.
Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.
NA Not Analyzed.
NM Due to pH probe malfunction, pH measurements were not reported.
NS Not Sampled. A wet weather sampling event was not conducted during the month of May 2014. There were a total of four storms in May 2014 with at least 0.1 inches of rain, which would qualify as wet weather events. Two storms occurred on weekends and two storms occurred overnight or outside low tide windows. Due to laboratory closure on weekends and evenings and low tide sampling requirements, a wet weather sampling event could not be completed.
TSS Total Suspended Solids

Table J-5 Logan Airport 2014 Monthly Monitoring Results for Second Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	4/15/2014	Wet Weather	-	-	NM	<4.0	50	<1.0	0.240	40	20
003 - Porter Street Outfall 2	4/15/2014	Wet Weather	-	-	NM	<4.0	28	<1.0	0.070	<10	120
003 - Porter Street Outfall 3	4/15/2014	Wet Weather	-	-	NM	<4.0	85	<1.0	0.130	4,500	260
003 - Porter Street Outfall Average		Wet Weather	2.53	0.44	NM	0.0	54	0.0	0.147	56	85
003 - Porter Street Outfall 1	4/21/2014	Dry Weather				<4.0	<5.0	<1.0	0.100	<10	<10
003 - Porter Street Outfall 2	4/21/2014	Dry Weather				<4.0	11	<1.0	<0.050	<10	<10
003 - Porter Street Outfall 3	4/21/2014	Dry Weather				<4.4	<5.0	<1.0	0.130	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	3.7	0.0	0.077	1.0	1.0
003 - Porter Street Outfall 1	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	1.18	0.24	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	5/16/2014	Dry Weather				<4.0	43	<1.0	0.170	<10	<10
003 - Porter Street Outfall 2	5/16/2014	Dry Weather				<4.0	72	<1.0	0.140	<10	<10
003 - Porter Street Outfall 3	5/16/2014	Dry Weather				<4.0	8.0	<1.0	0.120	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	41	0.0	0.143	1.0	1.0
003 - Porter Street Outfall 1	6/4/2014	Wet Weather	-	-	7.76	<4.0	22	<1.0	0.540	16,000	230
003 - Porter Street Outfall 2	6/4/2014	Wet Weather	-	-	8.08	<4.0	<5.0	<1.0	0.080	50	310
003 - Porter Street Outfall 3	6/4/2014	Wet Weather	-	-	8.01	<4.0	13	<1.0	0.310	60	310
003 - Porter Street Outfall Average		Wet Weather	2.34	0.21	7.95	0.0	11.7	0.0	0.310	363	281
003 - Porter Street Outfall 1	6/3/2014	Dry Weather				<4.0	39	<1.0	0.250	20	<10
003 - Porter Street Outfall 2	6/3/2014	Dry Weather				<4.0	19	<1.0	0.060	<10	10
003 - Porter Street Outfall 3	6/3/2014	Dry Weather				<4.0	12	<1.0	0.150	<10	40
003 - Porter Street Outfall Average		Dry Weather				0.0	23	0.0	0.153	2.71	7.37
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.

Notes: Flow rates were estimated for outfall 003 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

TSS Total Suspended Solids.

NM Due to pH probe malfunction, pH measurements were not reported.

NS Not Sampled. A wet weather sampling event was not conducted during the month of May 2014. There were a total of four storms in May 2014 with at least 0.1 inches of rain, which would qualify as wet weather events. Two storms occurred on weekends and two storms occurred overnight or outside low tide windows. Due to laboratory closure on weekends and evenings and low tide sampling requirements, a wet weather sampling event could not be completed.

Table J-6 Logan Airport 2014 Monthly Monitoring Results for Third Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	-	Wet Weather	6.31	0.45	NS	NS	NS	NS	NS	NS	NS	NS
002A – West Outfall	-	Wet Weather	22.17	1.61	NS	NS	NS	NS	NS	NS	NS	NS
004A – Maverick Street Outfall	-	Wet Weather	1.56	0.10	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	7/8/2014	Dry Weather				<4.0	20	<1.0	0.280	1,400	150	NA
002C – West Outfall	7/8/2014	Dry Weather				<4.0	14	<1.0	0.160	26,000	250	NA
004C – Maverick Street Outfall	7/8/2014	Dry Weather				<4.0	7.2	<1.0	0.080	23,000	2,100	NA
001A – North Outfall	8/13/2014	Wet Weather	2.93	0.18	8.34	<4.0	5.0	<1.0	0.180	70	1,800	NA
002A – West Outfall	8/13/2014	Wet Weather	10.12	0.62	7.91	13	250	<1.0	0.210	20,000	4,000	NA
004A – Maverick Street Outfall	8/13/2014	Wet Weather	0.88	0.03	7.60	<4.0	18	<1.0	0.180	>80,000	4,000	NA
001C – North Outfall	8/5/2014	Dry Weather				<4.0	12	<1.0	0.120	30	90	NA
002C – West Outfall	8/5/2014	Dry Weather				<4.0	15	<1.0	0.080	32,000	260	NA
004C – Maverick Street Outfall	8/5/2014	Dry Weather				<4.0	24	<1.0	0.060	21,000	250	NA
001A – North Outfall	-	Wet Weather	0.50	0.08	NS	NS	NS	NS	NS	NS	NS	NS
002A – West Outfall	-	Wet Weather	3.36	0.30	NS	NS	NS	NS	NS	NS	NS	NS
004A – Maverick Street Outfall	-	Wet Weather	0.17	0.01	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	9/4/2014	Dry Weather				<4.0	17	<1.0	0.230	230	160	NA
002C – West Outfall	9/4/2014	Dry Weather				<4.0	14	<1.0	0.100	14,000	130	NA
004C – Maverick Street Outfall	9/4/2014	Dry Weather				<4.0	26	<1.0	0.070	21,000	2,500	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	----	Report	Report	Report	Report	Report	Report

Source: Massport

Notes: Bold values exceed maximum daily discharge limitation.

Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.

For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

TSS Total Suspended Solids.

NA Not Analyzed.

NS Not Sampled. A wet weather sampling event was not conducted during the month of July 2014. There were a total of three storms in July 2014 that met the wet weather requirements of 0.1 inches of rain. Rainfall during two storms occurred during the evening and sampling could not be conducted in the morning due to tides. Sampling could not be conducted during the third event due to laboratory closure on the weekend. . A wet weather sampling event was not conducted during the month of September 2014 due to dry conditions.

Table J-7 Logan Airport 2014 Monthly Monitoring Results for Third Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	2.52	0.29	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	7/8/2014	Dry Weather				<4.0	18	<1.0	0.160	640	110
003 - Porter Street Outfall 2	7/8/2014	Dry Weather				<4.0	<5.0	<1.0	0.120	<10	50
003 - Porter Street Outfall 3	7/8/2014	Dry Weather				<4.0	<5.0	<1.0	0.150	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	6.0	0.0	0.143	9	18
003 - Porter Street Outfall 1	8/13/2014	Wet Weather	-	-	7.77	<4.0	21	<1.0	0.210	23,000	16,000
003 - Porter Street Outfall 2	8/13/2014	Wet Weather	-	-	8.44	<4.0	<5.0	<1.0	<0.050	10	20
003 - Porter Street Outfall 3	8/13/2014	Wet Weather	-	-	7.97	<4.0	<5.0	<1.0	0.090	220	1,200
003 - Porter Street Outfall Average		Wet Weather	1.90	0.08	8.06	0.0	7.0	0.0	0.100	370	727
003 - Porter Street Outfall 1	8/5/2014	Dry Weather				<4.0	25	<1.0	0.070	<10	60
003 - Porter Street Outfall 2	8/5/2014	Dry Weather				<4.0	<5.0	<1.0	0.200	20	10
003 - Porter Street Outfall 3	8/5/2014	Dry Weather				<4.0	31	<1.0	0.120	<10	<10
003 - Porter Street Outfall Average		Dry Weather				0.0	19	0.0	0.130	2.71	8.43
003 - Porter Street Outfall 1	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 2	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 3	-	Wet Weather	-	-	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall Average		Wet Weather	0.22	0.01	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	9/4/2014	Dry Weather				<4.0	77	<1.0	0.080	140	80
003 - Porter Street Outfall 2	9/4/2014	Dry Weather				<4.0	<5.0	<1.0	<0.050	<10	10
003 - Porter Street Outfall 3	9/4/2014	Dry Weather				<4.0	<5.0	<1.0	0.250	180	60
003 - Porter Street Outfall Average		Dry Weather				0.0	26	0.0	0.110	29	36
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.
Notes: Flow rates were estimated for outfall 003 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.
TSS Total Suspended Solids.
NS Not Sampled. A wet weather sampling event was not conducted during the month of July 2014. There were a total of three storms in July 2014 that met the wet weather requirements of 0.1 inches of rain. Rainfall during two storms occurred during the evening and sampling could not be conducted in the morning due to tides. Sampling could not be conducted during the third event due to laboratory closure on the weekend. A wet weather sampling event was not conducted during the month of September 2014 due to dry conditions.

Table J-8 Logan Airport Monthly Monitoring Results for Fourth Quarter — North, West, and Maverick Street Stormwater Outfalls

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)	*Klebsiella*[1] (cfu/100mL)
001A – North Outfall	10/16/2014	Wet Weather	9.67	0.64	6.53	<4.4	11	<1.0	0.100	2,100	170	NA
002A – West Outfall	10/16/2014	Wet Weather	37.34	2.36	6.87	<4.0	38	<1.0	0.080	1,200	270	NA
004A – Maverick Street Outfall	10/16/2014	Wet Weather	2.11	0.16	NS	NS	NS	NS	NS	NS	NS	NS
001C – North Outfall	10/10/2014	Dry Weather				<4.0	12	<1.0	0.070	2,600	70	NA
002C – West Outfall	10/10/2014	Dry Weather				<4.0	46	<1.0	0.070	1,600	80	NA
004C – Maverick Street Outfall	10/10/2014	Dry Weather				<4.0	29	<1.0	0.060	220	40	NA
001A – North Outfall	11/6/2014	Wet Weather	5.7	0.6	7.17	<4.0	9.3	<1.0	0.160	480	520	NA
002A – West Outfall	11/6/2014	Wet Weather	19.2	2.4	7.16	<4.0	19	<1.0	0.150	6,900	490	NA
004A – Maverick Street Outfall	11/6/2014	Wet Weather	1.4	0.1	6.82	<4.0	14	<1.0	0.100	30,000	740	NA
001C – North Outfall	11/11/2014	Dry Weather				<4.0	17	<1.0	0.160	100	170	NA
002C – West Outfall	11/11/2014	Dry Weather				<4.0	22	<1.0	0.200	240	10	NA
004C – Maverick Street Outfall	11/11/2014	Dry Weather				<4.0	17	<1.0	0.210	190	20	NA
001A – North Outfall	12/9/2014	Wet Weather	11.1	0.9	7.65	<4.0	71	<1.0	0.120	2,100	330	NA
002A – West Outfall	12/9/2014	Wet Weather	37.0	3.3	6.88	<4.0	34	<1.0	0.150	910	240	NA
004A – Maverick Street Outfall	12/9/2014	Wet Weather	02.8	0.2	7.62	<4.0	32	<1.0	0.120	1,200	360	NA
001C – North Outfall	12/15/2014	Dry Weather				<4.0	12	<1.0	0.070	10	130	NA
002C – West Outfall	12/15/2014	Dry Weather				<4.0	42	<1.0	<0.050	140	40	NA
004C – Maverick Street Outfall	12/15/2014	Dry Weather				<4.0	38	<1.0	<0.050	1,200	140	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily			Report	Report	6.0 to 8.5	15 mg/L	100 mg/L	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report	Report

Source: Massport.

Notes: Flow rates were estimated for outfalls 001, 002, and 004 by using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.

1 *Klebsiella* is an indication of non-fecal coliform bacteria and is tested for at the North Outfall when fecal coliform concentration exceeds 5,000 cfu/100ml.

TSS Total Suspended Solids.

NA Not Analyzed.

NS Not Sampled. Due to construction, the Maverick Street Outfall could not be sampled during the October wet weather event.

Table J-9 Logan Airport 2014 Monthly Monitoring Results for Fourth Quarter — Porter Street Stormwater Outfall

	Date	Event	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (S.U.)	Oil and Grease (mg/L)	TSS (mg/L)	Benzene (µg/L)	Surfactant (mg/L)	Fecal Coliform (cfu/100mL)	*Enterococcus* (cfu/100mL)
003 - Porter Street Outfall 1	10/16/2014	Wet Weather	-	-	7.23	<4.4	6.5	<1.0	0.110	<10	170
003 - Porter Street Outfall 2	10/16/2014	Wet Weather	-	-	7.44	<4.4	6.8	<1.0	0.130	<10	410
003 - Porter Street Outfall 3	10/16/2014	Wet Weather	-	-	7.88	<4.4	<5.0	<1.0	0.260	<10	11,000
003 - Porter Street Outfall Average		Wet Weather	7.81	0.44	7.52	0.0	4.4	0.0	0.167	1.0	915
003 - Porter Street Outfall 1	10/10/2014	Dry Weather				<4.0	<5.0	<1.0	0.060	<10	320
003 - Porter Street Outfall 2	10/10/2014	Dry Weather				<4.0	8.1	<1.0	<0.050	<10	30
003 - Porter Street Outfall 3	10/10/2014	Dry Weather				<4.0	7.6	<1.0	0.070	<10	1,500
003 - Porter Street Outfall Average		Dry Weather				0.0	5.2	0.0	0.043	1.0	243
003 - Porter Street Outfall 1	11/6/2014	Wet Weather	-	-	6.57	<4.0	32	<1.0	0.210	1,100	2,300
003 - Porter Street Outfall 2	11/6/2014	Wet Weather	-	-	7.69	<4.0	<5.0	<1.0	0.070	330	60
003 - Porter Street Outfall 3	11/6/2014	Wet Weather	-	-	7.60	<4.4	<5.0	<1.0	0.080	190	1,500
003 - Porter Street Outfall Average		Wet Weather	3.5	0.4	7.29	0.0	11	0.0	0.120	410	592
003 - Porter Street Outfall 1	11/11/2014	Dry Weather				<4.0	8.6	<1.0	0.120	20	80
003 - Porter Street Outfall 2	11/11/2014	Dry Weather				<4.4	5.7	<1.0	0.050	10	<10
003 - Porter Street Outfall 3	11/11/2014	Dry Weather				<4.0	<5.0	<1.0	0.140	<10	50
003 - Porter Street Outfall Average		Dry Weather				0.0	4.8	0.0	0.103	5.8	16
003 - Porter Street Outfall 1	12/9/2014	Wet Weather	-	-	7.36	<4.0	89	<1.0	<0.050	820	4,600
003 - Porter Street Outfall 2	12/9/2014	Wet Weather	-	-	6.42	<4.0	26	<1.0	<0.050	<10	150
003 - Porter Street Outfall 3	12/9/2014	Wet Weather	-	-	6.57	<4.0	10	<1.0	<0.050	40	230
003 - Porter Street Outfall Average		Wet Weather	7.2	0.6	6.78	0.0	42	0.0	0.0	32	541
003 - Porter Street Outfall 1	12/15/2014	Dry Weather				<4.0	13	<1.0	0.160	<10	<10
003 - Porter Street Outfall 2	12/15/2014	Dry Weather				16	14	<1.0	0.090	10	130
003 - Porter Street Outfall 3	12/15/2014	Dry Weather				<4.0	<5.0	<1.0	0.080	<10	<10
003 - Porter Street Outfall Average		Dry Weather				5.3	9.0	0.0	0.110	2.2	5.1
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily			Report	Report	6.0 to 8.5	Report	Report	Report	Report	Report	Report
Average Monthly			Report	Report	6.0 to 8.5	—	Report	Report	Report	Report	Report

Source: Massport.
Notes: Flow rates were estimated for outfall 003 using the SWMM model developed for Logan Airport.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit. For geometric mean calculations (fecal coliform and *Enterococcus*) a value of 1 was employed for those results measured below the laboratory detection limit.
TSS Total Suspended Solids.
NS Not Sampled. Due to weather and tidal conditions, a wet weather event was not conducted in October 2013.

Table J-10 Logan Airport 2014 Quarterly Wet Weather Monitoring Results – North, West, Maverick Street, and Porter Street Stormwater Outfalls

		Wet Weather									
	Date	pH (S.U.)	Benzo(a)-anthracene (µg/L)	Benzo(a)-pyrene (µg/L)	Benzo(b)-fluoranthene (µg/L)	Benzo(k)-fluoranthene (µg/L)	Chrysene (µg/L)	Dibenzo(a,h,)-anthracene (µg/L)	Indeno(1,2,3-cd)-pyrene (µg/L)	Naphthalene (µg/L)	Total PAHs (µg/L)
001 - North Outfall	3/20/2014	7.67	<10	<10	<10	<10	<10	<10	<10	<10	ND
002 - West Outfall	3/20/2014	7.22	<10	<10	<10	<10	<10	<10	<10	<10	ND
004 - Maverick Street Outfall	3/20/2014	7.07	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	3/20/2014	7.50	<10	<10	<10	<10	<10	<10	<10	<10	ND
003 - Porter Street Outfall 2	3/20/2014	7.49	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	3/20/2014	7.35	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average		7.45	ND	ND	ND	ND	ND	ND	ND	ND	ND
001 - North Outfall	6/4/2014	7.54	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	6/4/2014	7.65	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	6/4/2014	7.18	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	6/4/2014	7.76	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	6/4/2014	8.08	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	6/4/2014	8.01	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average		7.95	ND	ND	ND	ND	ND	ND	ND	ND	ND
001 - North Outfall	10/16/2014	6.53	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	10/16/2014	6.87	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	10/16/2014	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
003 - Porter Street Outfall 1	10/16/2014	7.23	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	10/16/2014	7.44	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	10/16/2014	7.88	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average	10/16/2014	7.52	ND	ND	ND	ND	ND	ND	ND	ND	ND
001 - North Outfall	12/9/2014	7.65	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
002 - West Outfall	12/9/2014	6.88	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
004 - Maverick Street Outfall	12/9/2014	7.62	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 1	12/9/2014	7.36	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 2	12/9/2014	6.42	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall 3	12/9/2014	6.57	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	ND
003 - Porter Street Outfall Average		6.78	ND	ND	ND	ND	ND	ND	ND	ND	ND
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.											
Discharge Limitations											
Maximum Daily		6.0 to 8.5	Report	Report	Report	Report	Report	Report	Report	Report	Total

Source: Massport

Notes: ND Not Detected; NS Not Sampled.
Due to construction, the Maverick Street Outfall could not be sampled during the 3rd Quarter wet weather event.
For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
PAH Polynuclear Aromatic Hydrocarbons.

Table J-11 Logan Airport 2014 Quarterly Wet Weather Monitoring Results – Northwest and Runway/Perimeter Stormwater Outfalls

	Date	Maximum Daily Flow (MGD)	Average Monthly Flow (MGD)	pH (SU)	Oil and Grease (mg/L)	Total Suspended Solids (mg/L)	Benzene (µg/L)
005 - Northwest Outfall	3/20/2014	1.14	0.08	7.17	<4.0	23	<1.0
006- Runway/ Perimeter Outfall (A9)	3/20/2014	0.68	0.06	7.41	<4.0	8.8	<1.0
006- Runway/ Perimeter Outfall (A17)	3/20/2014	0.26	0.02	7.34	<4.0	7.1	<1.0
006- Runway/ Perimeter Outfall (A20)	3/20/2014	0.30	0.03	7.14	<4.0	7.5	<1.0
006- Runway/ Perimeter Outfall (A21)	3/20/2014	5.82	0.52	7.11	<4.0	7.1	<1.0
006- Runway/ Perimeter Outfall (A23)	3/20/2014	0.53	0.05	7.15	<4.0	5.7	<1.0
006- Runway/ Perimeter Outfall (A33)	3/20/2014	0.35	0.04	7.16	<4.0	17	<1.0
006- Runway/ Perimeter Outfall (A38)	3/20/2014	0.81	0.05	7.18	<4.0	<5.0	<1.0
006- Runway/Perimeter Outfall Average		1.25	0.11	7.21	0.0	7.6	0.0
005 - Northwest Outfall	6/4/2014	0.37	0.04	7.32	<4.0	33	<1.0
006- Runway/ Perimeter Outfall (A9)	6/4/2014	0.18	0.03	7.96	<4.0	5.0	<1.0
006- Runway/ Perimeter Outfall (A15)	6/4/2014	0.08	0.01	7.83	<4.0	21	<1.0
006- Runway/ Perimeter Outfall (A17)	6/4/2014	0.08	0.01	8.14	<4.0	190	<1.0
006- Runway/ Perimeter Outfall (A21)	6/4/2014	1.50	0.22	7.58	<4.0	9.8	<1.0
006- Runway/ Perimeter Outfall (A23)	6/4/2014	0.15	0.02	7.59	<4.0	12	<1.0
006- Runway/ Perimeter Outfall (A33)	6/4/2014	0.13	0.02	7.78	<4.0	7.4	<1.0
006- Runway/ Perimeter Outfall (A38)	6/4/2014	0.20	0.02	7.26	<4.0	8.9	<1.0
006- Runway/Perimeter Outfall Average		0.33	0.05	7.73	0.0	36	0.0
005 - Northwest Outfall	10/16/2014	1.19	0.08	6.41	<4.0	13	<1.0
006- Runway/ Perimeter Outfall (A8)	10/16/2014	0.72	0.04	6.47	<4.0	11	<1.0
006- Runway/ Perimeter Outfall (A21)	10/16/2014	6.00	0.34	6.81	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A22)	10/16/2014	3.11	0.19	6.76	<4.0	8.5	<1.0
006- Runway/ Perimeter Outfall (A29)	10/16/2014	2.29	0.11	7.29	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A31)	10/16/2014	0.46	0.03	6.74	<4.0	5.4	<1.0
006- Runway/ Perimeter Outfall (A34)	10/16/2014	2.41	0.12	6.61	<4.0	12	<1.0
006- Runway/ Perimeter Outfall (A38)	10/16/2014	0.88	0.04	6.73	<4.0	17	<1.0
006- Runway/Perimeter Outfall Average		2.27	0.12	6.77	0.0	7.7	0.0
005 - Northwest Outfall	12/9/2014	1.5	0.1	7.27	<4.0	68	<1.0
006- Runway/ Perimeter Outfall (A9)	12/9/2014	0.8	0.1	7.80	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A18)	12/9/2014	0.1	0.0	6.94	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A19)	12/9/2014	0.1	0.0	7.11	<4.0	<5.0	<1.0
006- Runway/ Perimeter Outfall (A21)	12/9/2014	6.7	0.5	6.99	<4.0	19	<1.0
006- Runway/ Perimeter Outfall (A23)	12/9/2014	0.6	0.0	6.74	<4.0	60	<1.0
006- Runway/ Perimeter Outfall (A33)	12/9/2014	0.3	0.0	7.54	<4.0	5.3	<1.0
006- Runway/ Perimeter Outfall (A38)	12/9/2014	1.0	0.0	7.54	<4.0	94	<1.0
006- Runway/Perimeter Outfall Average		1.4	0.1	7.24	0.0	25	0.0
Discharge Limitations		Report	Report	Report	Report	Report	Report

Source: Massport; Notes: Requirements are from NPDES Permit MA 0000787, issued July 31, 2007

Table J-12 Logan Airport 2014 Wet Weather Deicing Monitoring Results – North, West, Porter Street and Runway/Perimeter Stormwater Outfalls

	Date	Ethylene Glycol, Total (mg/L)	Propylene Glycol, Total (mg/L)	BOD_5 (mg/L)	COD (mg/L)	Total Ammonia Nitrogen (mg/L of N)	Chloride (mg/L)	Nonylphenol (µg/L)	4-Methyl-1-H-benzotriazole (µg/L)	5-Methyl-1-H-benzotriazole (µg/L)	Tolytriazole (µg/L)	Whole Effluent Toxicity
001 - North Outfall	2/13/2014	170	1,900	2,500	4,400	0.468	NA	<0.02	81.99	103.22	185.21	NA
002 - West Outfall	2/13/2014	600	14,000	15,000	24,000	1.32	NA	<0.02	237.40	330.60	568.00	NA
003B - Porter Street 1	2/13/2014	22	93	70	1,300	0.843	NA	<0.02	6.36	5.01	11.37	NA
003B - Porter Street 2	2/13/2014	7.1	28	240	420	0.111	NA	1.91	42.19	87.48	129.67	NA
003B - Porter Street 3	2/13/2014	<7.0	<7.0	200	1,400	0.508	NA	<0.02	2.45 J	3.01	5.46 J	NA
003B - Porter Street Outfall Average		9.7	40.3	170	1,040	0.487	NA	0.64	17.00 J	31.83	48.83 J	NA
006- Runway/ Perimeter (A9)	2/13/2014	<7.0	<7.0	5.3	100	0.445	NA	<0.02	7.33	2.66	9.99	NA
006- Runway/ Perimeter (A15)	2/13/2014	<7.0	<7.0	3.5	<40	2.47	NA	<0.02	9.07	3.40	12.47	NA
006- Runway/ Perimeter (A18)	2/13/2014	<7.0	<7.0	30	74	5.75	NA	<0.02	16.30	5.61	21.91	NA
006- Runway/ Perimeter (A21)	2/13/2014	<7.0	<7.0	170	1,400	0.992	NA	0.23 J	10.60	8.91	19.51	NA
006- Runway/ Perimeter (A23)	2/13/2014	<7.0	<7.0	3.8	160	2.89	NA	<0.02	18.08	4.40	22.48	NA
006- Runway/ Perimeter (A33)	2/13/2014	NS	NS	NS	NS	NS	NA	NS	NS	NS	NS	NA
006- Runway/ Perimeter (A38)	2/13/2014	NS	NS	NS	NS	NS	NA	NS	NS	NS	NS	NA
006- Runway/Perimeter Outfall												NA
Average		0.0	0.0	42.5	347	2.51	NA	0.046 J	12.28	5.00	17.27	NA
Requirements are from NPDES Permit MA0000787, issued July 31, 2007.												
Discharge Limitations												
Maximum Daily		Report	Report	Report	Report	Report	Report	Report	Report	Report	Report	Report

Source: Massport.
Notes: For averaging calculations, a value of zero was employed for those results measured below the laboratory detection limit.
J = Value is an estimate calculated by the lab from the response factors of the other two triazole compounds.
Tolytriazole concentrations calculated as sum of 4-Methly-1-H-benzotriazole and 5-Methyl-1-H-benzotriazole.
BOD_5 Five-day Biochemical Oxygen Demand
COD Chemical Oxygen Demand
NA Not Analyzed
NS Not Sampled. Locations were inaccessible due to snowy road conditions and visibility issues.

Table J-13 Logan Airport Stormwater Outfall NPDES Water Quality Monitoring Results – 1993 to 2014

	1993	1994	1995	1996	1997	1998	1999	2000	2001[1]	2002	2003[1]	2004	2005	2006	2007	2008	2009	2010[1,2]	2011[2]	2012	2013	2014
# / # = Number of samples at or below NPDES limits / Total number of samples taken																						
Oil and Grease (mg/L)																						
North Outfall	30/31	35/36	33/35	29/35	30/35	35/36	29/30	34/36	28/28	36/36	30/32	32/34	33/35	33/33	29/29	23/23	24/24	24/24	24/24	21/21	20/20	21/21
West Outfall	29/30	36/36	34/34	36/36	34/35	36/36	30/30	35/35	27/28	36/36	31/32	33/34	35/35	32/33	28/28	22/23	24/24	24/24	22/24	21/21	21/21	21/21
Porter Street Outfall[2]	30/30	35/36	34/34	36/36	35/35	34/36	30/30	35/36	28/28	34/36	32/32	33/34	34/35	33/33	22/22	50/50	72/72	50/50	49/49	62/62	63/63	63/63
Maverick Street Outfall	29/29	36/36	35/35	36/36	35/35	35/36	30/30	34/34	26/28	35/36	32/32	34/34	35/35	32/33	29/29	22/23	20/21	19/19	23/23	15/15	4/4	20/20
Settleable Solids[3] (mg/L)																						
North Outfall	19/19	34/35	34/35	32/35	31/34	34/36	30/30	34/36	29/29	32/36	32/32	34/34	33/35	32/34	22/22	n/a	n/a	n/a	n/a	n/a	n/a	n/a
West Outfall	19/19	32/36	34/34	35/36	34/34	35/36	29/30	36/36	27/28	36/36	31/32	34/34	32/35	33/33	22/22	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TSS (mg/L)																						
North Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6/6	24/24	24/24	22/23	24/24	21/21	20/21	21/21
West Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5/6	24/24	24/24	23/23	22/24	20/22	21/21	20/21
Maverick Street Outfall	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4/6	22/24	20/21	18/19	20/23	14/15	4/4	19/20
pH																						
North Outfall	34/35	33/36	35/35	35/35	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	34/34	26/26	12/12	16/16	11/11	12/12	9/9	8/8	8/8
West Outfall	34/34	28/36	33/34	35/36	35/35	36/36	30/30	36/36	29/29	36/36	32/32	34/34	35/35	33/33	26/26	12/12	16/16	11/11	12/12	9/9	9/9	8/8
Porter Street Outfall[2]	35/35	30/36	34/34	36/36	35/35	36/36	30/30	36/36	28/28	36/36	32/32	34/34	35/35	33/33	22/22	21/21	48/48	24/24	23/23	26/27	24/27	24/24
Maverick Street Outfall	35/35	35/36	35/35	36/36	34/35	36/36	30/30	35/35	28/28	36/36	32/32	34/34	35/35	33/33	26/26	10/10	16/16	10/10	11/11	6/6	2/2	7/7

Source: Massport

Notes: Sampling requirements changed in 2007 with the issuance of a new NPDES permit. Results through 2007 are based on NPDES Permit MA0000787, issued March 1, 1978. Stormwater outfall water quality monitoring results collected in accordance with the requirements of former NPDES permit. A portion of the Porter Street Drainage Area was incorporated into the West Drainage Area as part of roadway construction projects at Logan Airport.

1 In 2001, 2003, and 2010, exceptional weather, tidal conditions, or insufficient discharge precluded the collection of some samples, leading to a fewer number of samples collected than in other years.

2 In 2010 and 2011, Porter Street Outfall 1 and Porter Street Outfall 3 were not accessible due to construction, leading to a fewer number of samples collected than in other years. A new sampling location was established for Porter Street Outfall 3 and it was sampled for the first time on February 18, 2011. Porter Street Outfall 1 was accessible again in December 2011.

3 In 2013, due to construction, a fewer number of samples were collected at the Maverick Street outfall than in other years.

4 Settleable solids analyses were replaced with TSS in 2008.

Table J-14 Logan Airport Oil and Hazardous Material Spills[1] and Jet Fuel Handling – 1990 to 2014

Year	Total Number of all Spills	Total Number of all Spills >10 gallons	Total Volume of all Spills (Gallons)	Estimated Volume of Jet Fuel Handled (Gallons)	Total Volume of Jet Fuel Spilled (Gallons)
1990	173	NA	NA	438,100,000	3,745
1991	186	NA	NA	NA	2,471
1992	195	NA	NA	NA	4,355
1993	188	NA	NA	451,900,000	3,131
1994	217	NA	NA	476,700,000	4,046
1995	161	NA	NA	309,200,000	21,412[2]
1996	159	NA	NA	346,700,000	1,321
1997	147	NA	NA	377,488,161	2,029[3]
1998	191	NA	NA	387,224,004	10,047[4]
1999	196	43	7,151	425,937,051	7,012[5]
2000	136	20	1,318	441,901,932	1,227
2001	139	37	1,924	416,748,819	1,771
2002	101	16	653	358,190,362	559
2003	128	19	10,364	319,439,910	10,188[6]
2004	126	18	894	373,996,141	574
2005	97	15	2,319	368,645,932	585
2006	92	11	752	364,450,864	644
2007	108	7	604	367,585,187	361
2008	99	20	944	345,631,788	662
2009	95	6	1004	327,358,619	915
2010	87	15	476	335,693,997	360
2011	108	12	572	340,421,373	337
2012	132	5	593	343,731,127	439
2013	94	6	452	349,397,940	351
2014	129	17	2,785	370,222,342	785

Source: Massport Fire-Rescue Department.
NA Not available.
1 Materials include: jet fuel, hydraulic oil, diesel fuel, gasoline, and other materials such as glycol and paint.
2 One tenant spill, which occurred on October 15, 1995, totaled 18,000 gallons (84 percent of the annual spill total). The spill did not enter the Airport's storm drain system.
3 On October 23, 1997, a fuel line on an aircraft failed, resulting in the release of approximately 2,500 gallons, all but 60 gallons of which were recovered in drums before reaching the ground. Only the 60 gallons is included in the 1997 total.
4 Includes a 7,200-gallon spill that was discovered on September 2, 1998, and a 1,300-gallon spill that occurred on June 3, 1998. Neither spill entered the Airport's storm drain system.
5 Includes a 5,000-gallon spill, none of which entered the Airport's storm drainage system.
6 In 2003, one fuel spill comprised 9,460 gallons or 94 percent of the total volume of the MassDEP/MCP reportable spills that year. The fuel spill was contained and did not enter the drainage system.

Table J-15 Type and Quantity of Oil and Hazardous Material Spills at Logan Airport – 1999 to 2014

	Jet Fuel			Hydraulic Oil			Diesel Fuel			Gasoline			Other		
Year	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons	No. of Spills	Quantity (Gallons)	No. of Spills ≥10 Gallons
1999	151	7,012	40	24	67	1	13	49	2	5	7	0	3	16	0
2000	115	1,227	18	8	59	2	3	11	0	8	16	0	2	5	0
2001	104	1,771	32	21	92	3	5	30	1	6	26	1	3	5	0
2002	79	559	15	7	38	0	8	37	1	4	8	0	3	11	0
2003	89	10,188	15	15	91	3	15	30	0	7	24	0	2	31	1
2004	82	574	12	17	189	4	14	52	0	7	26	0	6[1]	53[2]	2[3]
2005	66	585	12	14	78	1	7	1,610	2	7	45	0	3[4]	1	0
2006	65	644	9	10	25	0	6	57	1	4	9	0	7	17	1
2007	66	361	4	16	37	0	16	57	1	3	8	0	7	141[5]	2
2008	74	662	19	15	56	2	5	14	0	1	7	0	4	205[6]	1
2009	95	915	6	21	51	0	9	20	0	3	3	0	11	15	0
2010	54	360	12	17	50	1	5	56	2	2	3	0	7	7	0
2011	69	337	10	21	149	1	7	55	1	4	16	0	7	15	0
2012	80	439	4	25	79	1	17	38	0	2	12	0	8	25	0
2013	56	351	5	15	51	0	13	32	0	2	<2	0	7	10	0
2014	81	785	13	24	98	1	17	1,810	2	4	9	0	3	83	1

Source: Massport
Notes:
1 Includes two Unknown spills (14 gallons), plus one spill of each of the following: Ethylene Glycol, Propylene Glycol, AVGAS, and Paint.
2 Ethylene Glycol (25 gallons), Propylene Glycol (10 gallons), AVGAS (1 gallon) and Paint (3 gallons).
3 One spill of Ethylene Glycol; one spill of Propylene Glycol.
4 Includes two spills of an unknown substance and volume.
5 Includes one spill of motor oil (4 gallons); one spill of kerosene (5 gallons); one spill of cooking oil (120 gallons); one spill of fuel oil (10 gallons); one spill from a battery (1 gallon); two spills of an unknown substance (1 gallon).
6 Includes one spill of transformer oil (200 gallons).

Table J-16 MCP Activities Status of Massport Sites at Logan Airport	
Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
1. Fuel Distribution System (3-1287) (continued)	
2007	Inspection and Monitoring Status Reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2006 and September 2007. A Periodic Evaluation Report was submitted in January 2008 which indicated that a Condition of No Substantial Hazard existed at the FDS and a permanent solution was not currently feasible. Massport coordinated with BOSFUEL who prepared construction documents for replacing a portion of the FDS. Construction was conducted under a RAM Plan.
2008	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2007 and September 2008. Massport coordinated with BOSFUEL during construction to replace a portion of the FDS. The work was conducted under a RAM Plan that was submitted to the MassDEP in May 2008. A RAM Status Report was submitted in September 2008. Construction of the pipeline replacement was approximately 90 percent complete.
2009	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2008 and December 2009. The BOSFUEL project to replace a portion of the FDS continued, with work being completed on pipeline connections, testing of the new fuel line, and abandonment of the old fuel line. RAM Status Reports for the BOSFUEL Project were submitted in February and September 2009.
2010	Inspection and monitoring reports were submitted to the MassDEP detailing monitoring and product recovery efforts along the FDS between September 2009 and September 2010. A RAM Completion Report for the BOSFUEL Project was submitted in February, and the report was revised in March 2010.
2011	A Periodic Review of the Temporary Solution for the FDS was submitted in April 2011. Additionally, three Post-Class C RAO Status Reports were submitted for the FDS in February, June, and December 2011, summarizing the routine inspection and monitoring activities.
2012	Post-Class C RAO Status Reports were submitted in May and November 2012, summarizing the routine inspection and monitoring activities.
2013	Post-Class C RAO Status Reports were submitted in May and November 2013, summarizing the routine inspection and monitoring activities.
2014	Post-Class C RAO Status Reports were submitted in May and November 2014, summarizing the routine inspection and monitoring activities. In addition, a RAM Plan was submitted in April 2014 to address construction in the area of the FDS followed by a RAM Completion Report submitted in August 2014.
2. North Outfall (3-4837)	
Phase II and Phase III Reports filed in March 1997	Indicated petroleum contamination present at the site was likely the result of decades of airport operation; risk assessment reported no significant risk to human health, or to the aquatic and avian community.
RAO submitted in March 1998	Class C RAO using a Temporary Solution (periodic site monitoring and assessment); remediation steps included (not limited to) installation of a new fuel distribution system and decommissioning of certain fuel lines, and natural biodegradation processes; goal is to have petroleum contamination reduced to an area less than 1,000 square feet. Installation of the new fuel distribution system and decommissioning of sections of the old system were completed. Massport initiated site evaluation to document the reduction of petroleum contamination following the decommissioning of the North Fuel Farm and fuel distribution system.
Post Class C RAO evaluation report submitted in December 2002	Massport has eliminated substantial hazards at this site and submitted a Class C RAO statement. In accordance with applicable regulations, Massport will conduct a periodic evaluation at five-year intervals until a Permanent Solution has been achieved. The next periodic evaluation was scheduled for 2007.

Table J-16	MCP Activities Status of Massport Sites at Logan Airport (Continued)
Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
2. North Outfall (3-4837) (continued)	
2004	Evaluation report indicated that a "Condition of No Significant Risk" has not been achieved at this site. Massport scheduled another assessment in 2007.
2005	No change in status for 2005.
2006	Massport prepared the five-year review of the Class C RAO for this site, which was due in December 2007.
2007	Massport completed its five-year review of the Class C RAO and transmitted it to MassDEP in December 2007. It was determined that a "Condition of No Significant Risk" has not been achieved at this site at this time. The next five-year re-evaluation will be conducted in 2012.
2008	No change in status.
2009	No change in status.
2010	No change in status.
2011	No change in status. Massport provided updated data for the MassDEP website.
2012	Response Action Outcome submitted to DEP on December 27, 2012. No further MCP response action is required.
3. Former Robie Park (3-10027)	
2005	A Phase I was completed in 2005 with an RAO retraction. The RAO had been completed by the former property owner.
2006	No change in status for 2006.
2007	No change in status for 2007.
2008	A Phase II Scope of Work was prepared on May 9, 2008. A RAM Plan was submitted to MassDEP on September 16, 2008.
2009	A Phase V Remedy Operation Status Plan was submitted on March 31, 2010.
2010	Two Remedy Operation Status Reports were submitted on September 29, 2010 and March 28, 2011. The next status report was scheduled for September 30, 2011.
2011	Phase IV Project Status Reports 2 and 3 were submitted in March and September 2011, respectively.
2012	Phase V Status Reports 4 and 5 were submitted in March and September, 2012, respectively.
2013	Phase V Status Reports 6 and 7 were submitted in March and September, 2013, respectively.
2014	Phase V Status Reports 8 and 9 were submitted in March and September, 2014, respectively.
4. Former Robie Property (3-23493)	
2005	A Phase I was completed in 2005.
2006	No change in status for 2006.
2007	No change in status for 2007.
2008	A Phase II was submitted to MassDEP on October 21, 2008.
2009	An Activity and Use Limitation (AUL) was recorded with the Suffolk County Registry of Deeds for the site on December 16, 2009.

Table J-16 MCP Activities Status of Massport Sites at Logan Airport (Continued)

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
2010	A Class A-3 RAO was submitted on January 4, 2010, corresponding with the recording of an AUL. On May 21, 2010, a RAM Plan for the Economy Parking Structure was submitted. The first RAM Status Report was submitted on September 21, 2010. An AUL Amendment was recorded on December 9, 2010.
2011	A RAM Completion Statement was submitted on March 15, 2011. Regulatory closure has been achieved. No further response actions are required.
5. Tomahawk Drive (3-27068)	
2007	Release notification form submitted in August 2007.
2008	A Class B-1 RAO was submitted to MassDEP on January 9, 2009. No further response actions were required.
2009	No further response actions were required.
2010	No further response actions were required.
2011	No further response actions required.
6. Fire Training Facility (3-28199)	
2008	Oral notification of release was provided to MassDEP/BWSC on December 10, 2008
2009	A Phase I/Tier classification was submitted on December 17, 2009.
2010	A RAM Plan was submitted to MassDEP on August 6, 2010. A RAM Status Report was submitted to MassDEP on December 3, 2010.
2011	A RAM Completion Statement was submitted on April 25, 2011.
	A Phase II Scope of Work was prepared and submitted to MassDEP on January 18, 2011. Phase II and Phase III Reports were submitted on December 8, 2011. A RAM Completion Statement was submitted on April 25, 2011.
2012	Phase 4 Status Report transmitted in June 2012; the Phase IV Remedy Implementation Plan was submitted in December 2012.
2013	Phase 4 Status Report transmitted in June 2013, the Phase IV Completion Report was transmitted in December 2013.
2014	Phase 5 Remedy Operation Status Reports submitted in June and December, 2014.
7. Southwest Service Area (3-28792)	
2009	Release notification form was submitted to MassDEP/BWSC on October 8, 2009.
2010	A Class B-1 RAO was submitted to MassDEP on October 18, 2010. No further response actions required.
2011	No further response actions required.
8. Airfield Duct Bank Site (3-29716)	
2010	Release notification form was submitted on December 22, 2010.
2011	A Class A-1 RAO was submitted on December 23, 2011. No further response actions required.
9. West Outfall Release (3-29792) 2011	Release notification form was submitted on April 8, 2011. Two IRA Status Reports were submitted to MassDEP on June 9 and December 5, 2011. An RAO was submitted on February 13, 2012. No further response actions required.

Table J-16 MCP Activities Status of Massport Sites at Logan Airport (Continued)

Location (Release Tracking Number) and MassDEP Reporting Status	Action/Status
10. Hertz Parking Lot Site (3-30260)	Release notification form was submitted on August 29, 2011.
2011	A RAM Plan was submitted to MassDEP on September 1, 2011.
2012	A Class A-2 RAO was submitted on September 10, 2012. No further response actions required.
11. Former Butler Aviation Hangar (3-30654)	Verbal notification of a release was provided to the DEP on February 14, 2012, when RCC construction encountered an unidentified underground storage, and a Release Notification Form was submitted on April 23, 2012.
2012	An IRA Plan was submitted on May 21, and IRA Status Reports were submitted on June 18 and December 26, 2012.
2013	Phase I Report and Tier Classification submitted February 21, 2013 and IRA Completion Report submitted on July 11, 2013
2014	A Permanent Solution Statement was submitted in October 2014. No further response actions required.
12. Hangar 16 (3-32351)	Release Notification Form submitted August 4, 2014.

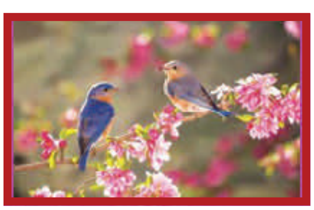
Capital Programs and Environmental Affairs

EnviroNews

A Massport Tenant Newsletter

Volume 40, Issue 1
March 2014

INSIDE THIS ISSUE:



EnviroNews is a newsletter published quarterly for Massport and its Tenants. Your comments and suggestions are welcome. Please contact Brenda Enos (benos@massport.com) at 617-568-5963.

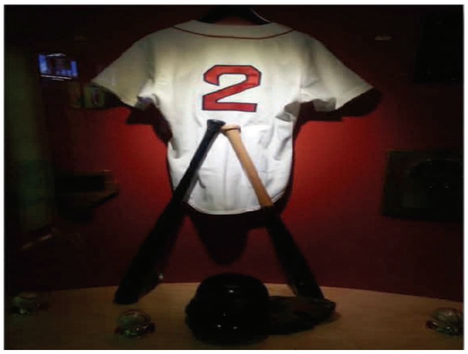
Material Safety Data Sheets (MSDS) will soon be Safety Data Sheets (SDS). What's the Difference?

You may remember that the OSHA Hazard Communication Standard requires chemical manufacturers or distributors to provide Material Safety Data Sheets (MSDS) to communicate the hazards of chemical products. Based on the MSDS provisions in HazCom 1994, there are currently a number of different MSDS styles and formats in use in the United States; the most common being the "8 section OSHA MSDS" and the "16 section ANSI MSDS". OSHA's adoption of Globally Harmonized System (GHS) via HazCom 2012, mandates the use of a single GHS format for safety data sheets, a format which features 16 sections in a strict ordering beginning June 1, 2015. The new format includes the following sections as well as the pictograms to the below:

1. **Identification** includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
2. **Hazard(s) identification** includes all hazards regarding the chemical; required label elements.
3. **Composition/information on ingredients** includes information on chemical ingredients; trade secret claims.
4. **First-aid measures** includes important symptoms/ effects, acute, delayed; required treatment.
5. **Fire-fighting measures** lists suitable extinguishing techniques, equipment; chemical hazards from fire.
6. **Accidental release measures** lists emergency procedures; protective equipment; proper methods of containment and cleanup.
7. **Handling and storage** lists precautions for safe handling and storage, including incompatibilities.
8. **Exposure controls/personal protection** lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).
9. **Physical and chemical properties** lists the chemical's characteristics.
10. **Stability and reactivity** lists chemical stability and possibility of hazardous reactions.
11. **Toxicological information** includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.
12. **Ecological information**
13. **Disposal considerations**
14. **Transport information**
15. **Regulatory information**

16 **Other information,** includes the date of preparation or last revision.

Continued on Page 2



Massport Scavenger Hunt!

Opening day at Fenway is right around the corner. Check out famous Red Sox memorabilia at Logan Airport!

Find its location and take a picture next to it and send the picture to obrazoban@massport.com. The first submission will get some great giveaways!

Good Luck!

Material Safety Data Sheets (MSDS) will soon be Safety Data Sheets SDS. What's the Difference? (cont..from page 1)

There are other requirements for the new OSHA HazCom. The table below summarizes the phase-in dates required under the revised Standard.

Effective Completion Date	Requirement(s)	Who
December 1, 2013	Train employees on the new label elements and safety data sheet (SDS) format.	Employers
June 1, 2015* December 1, 2015	Compliance with all modified provisions of this final rule, except: The Distributor shall not ship containers labeled by the chemical manufacturer or importer unless it is a GHS label.	Chemical manufacturers, importers, distributors and employers
June 1, 2016	Update alternative workplace labeling and hazard communication program as necessary, and provide additional employee training for newly identified physical or health hazards.	Employers
Transition Period to the effective completion dates noted above	May comply with either 29 CFR 1910.1200 (the final standard), or the current standard, or both.	Chemical manufacturers, importers, distributors, and employers

For more information, you can visit the OSHA website at: https://www.osha.gov/dsg/hazcom/ghs.html.

Recycling Program Update

New Recycling Images,

Separating paper and plastic is a thing of the past here at Massport, wth the roll out of our new Single Stream program. "Single Stream" recycling also known as "Fully Commingled" or "Single Sort" allows paper, plastic, cardboard, glass and metals to be recycled in the same container. "Single Stream" recycling makes it easier for passengers and employees to recycle.

Many of you may have noticed the recycling barrels inside the terminals wrapped with a new beautiful Boston background. The blue on the top of the background makes the recycling barrels easy to spot. The new recycling wrap displays what is acceptable and not acceptable under the Single Stream program.

The new dumpsters compact trash and recyclables with just a push of a button. The dumpsters are designed to compress what's inside 3 times over, eliminating wasted space from large items, e.g., boxes and large pieces of cardboard. Aside from the advanced features, we also applied a simple yet significant mechanism to the dumpster doors. The "switched" door works exactly like a mailbox door. It will only take objects in after the door is closed back up, preventing birds from opening up the bags and debris from flying out. The "Safety Switch" door on the other side has a sensor that informs the compactor whether the door is closed or open. The dumpsters will not compact unless the sensor door is closed, this will prevent serious injuries if workers ever try to get into the dumpster to push in the bags.

massport

2014 Earth Day
Household Hazardous Waste Collection

Airport Locations

Logan- Massport Fire Rescue Station 1
April 22nd 9am-2pm

Worcester- Gate 18 (Near Maintenance Facility)
April 30th 9am-12pm

Hanscom- Civil Air Terminal Parking Lot
May 7th 9am-1pm

Accepted Items

Dry and wet chemicals like Oiled Based Paint, Cleaners, and Pesticides

E-Waste (36" in size) like Televisions, Monitors, Computers

Laptops, Projectors, Cell-phones, Scanners, Fax Machines etc...

**Detailed list on the back

For more information contact

Glenn Adams: gadams@Massport.com
Oscar Brazoban: obrazoban@Massport.com

*NO COMMERCIALLY GENERATED WASTE, HOUSEHOLD ONLY**

WE RESERVE THE RIGHT TO REJECT ANY MATERIALS.

Acceptable Items

- Aerosol Products
- Antifreeze
- Appliances with Chlorofluorocarbons (CFC's)
  - Refrigerators, freezers, air conditioners and dehumidifiers containing CFC's
- Automotive Batteries
- Household Batteries
  - Lithium batteries should be taped
- Driveway Sealer
- Electronics & Cathode Ray Tubes
- Empty Fire Extinguishers
- Propane Tanks (empty or full) <u>with no valves</u>
- Fluorescent Light Bulbs
- Mercury Devices and Liquid Mercury
- Microwaves
- Motor Oil
- Muriatic (Hydrochloric)Acid
- Thinners and Solvents

Not Acceptable

- Ammunition
- Compressed Gas Cylinders (except propane)
- Fireworks
- Gun Powder
- Latex Paint
- Lead Acid Batteries
- Medical Wastes
- Prescription Drugs
- Radioactive Wastes
- Smoke Detectors
- Stereos
- Tires

Logan Airport's Sustainability Management Plan – Project Update

The Project Team met with Bill Crowley to discuss Fleet sustainability on November 5, 2013.

Since our last Sustainability Management Plan (SMP) update, the Massport Sustainability Working Group (SWG) and the Project Team have made significant progress. One of the first action items for the SMP was to conduct a thorough baseline assessment of Logan Airport's current sustainability performance; an initial draft of the document was completed in February 2014. The Project Team interviewed over 30 Massport staff members between November 2013 and January 2014, as part of the data gathering effort for this assessment. Staff members represented many departments, including Aviation Administration, Capital Programs, the Airport Business Office, Economic Planning and Development, Facilities, Fleet, Landscaping, Risk Management, Human Resources, Purchasing, Utilities Control, Administration and Finance, Aviation Customer Service, Legal, Information Technology, and Community Relations.

In addition to completing an initial draft of the baseline assessment, the Project Team held a second SWG meeting at Massport on December 12, 2013. At this meeting, the SWG heard from Leith Sharp, Founding Director of the Harvard Green Campus Initiative. Leith Sharp discussed how sustainability can be successful at Massport and how Harvard, as an institution, has many parallels to Massport. The next SWG meeting is scheduled for spring 2014. At this meeting, the SWG will work toward developing goals, crafting a sustainability mission statement, and identifying potential sustainability initiatives.

During this most recent reporting period, the Project Team also met with Capital Programs staff to brief them on the SMP and sustainability.

As part of the Baseline Assessment, the consultant team identified Massport's notable achievements. Notable achievements from the key resource areas include:

- ◊ Massport has used warm mix asphalt (WMA) for many runway and roadway paving projects. This process produces 20 percent less greenhouse gas (GHG) emissions than standard hot mix asphalt. Benefits also include fewer fumes for workers.
- ◊ Logan Airport's Terminal A was the first LEED™-certified airport terminal in the world. LEED™, or Leadership in Energy & Environmental Design, provides third-party certification of green buildings.
- ◊ Recycled water is used at the Green Bus Depot for airport shuttle bus washing. This initiative reduces the demand for potable water sources.
- ◊ Massport's Residential Sound Insulation Program (RSIP) is one of the longest running and most extensive sound insulation programs in the country. RSIP was initiated in 1984 as a pilot program; in 1986 it graduated to a long-range program. The program has retrofitted thousands of homes and dozens of schools since its inception.
- ◊ Massport's recently constructed Rental Car Center (RCC) streamlined rental car operations by providing a centralized location and covered parking for all rental car companies. The RCC is served by the Airport's clean fleet of shuttle buses rather than the individual company shuttles.
- ◊ In an effort to protect bird species while enhancing safety at the Airport, Massport works closely with the Massachusetts Audubon Society to trap and relocate snowy owls that stop at the Airport during their migration north. The owls are relocated north of the Airport on Plum Island, where they can continue their migration.

Questions about Environmental/Safety Issues

Who should you contact?

Contact	Phone Number	Email Address
Auditing/General EMS/Sustainability		
Brenda Enos	(617) 568-5963	benos@massport.com
Recycling/Universal Waste		
Glenn Adams	(617) 568-3542	gadams@massport.com
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Capital Programs and Environmental Affairs

EnviroNews

A Massport Newsletter

Volume 40, Issue 2
July 2014

INSIDE THIS ISSUE:

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Logan Airport's Sustainability Management Plan Update

The Logan Airport Sustainability Management Plan (SMP) has come a long way over the last few months, and a lot of excitement is building as we start to communicate our sustainability successes and approach to the Massport organization. In March 2014, the Project Team held a four-hour long workshop with Capital Programs to explore ways of sharing information regarding sustainability efforts. During the workshop, participants brainstormed ways to promote sustainability internally as well as to the traveling public.

In addition to crafting a sustainability message, the Project Team is developing a Sustainability Index that Massport will be able to use to assess annual progress. Progress on implementing sustainability initiatives will be assessed by tracking key performance indicators, such as water use and recycling rates.

In May 2014, the Sustainability Working Group (SWG) met to draft a sustainability mission statement and to identify goals, objectives, metrics, and targets.

Mission statement options were developed based on input received from the SWG during the December 2013 meeting and from a survey conducted through MindMixer, an online engagement tool. The mission statement will serve as a guide for Massport along its sustainability path.

After completion of a baseline assessment in February 2014, goals and targets were drafted for the following six priority categories:

- Energy;
- Greenhouse Gas Reduction;
- Climate Change Adaptation;
- Water Conservation;
- Waste Management; and
- Community.

Photos from the March 2014 workshop with Capital Programs. Attendees were divided into four groups, and asked to develop a "pitch for sustainability."

Resiliency Program Update

Hurricane Sandy: LaGuardia Airport flooded

The term "resiliency" refers to the ability of a system to withstand a major disruption within acceptable degradation parameters, recover within an acceptable time, and balance composite costs and risks; think Superstorm Sandy and New York/New Jersey. As part of Massport's strategic planning process, a group of staff and consultants have been incorporating resiliency thinking into Massport's long range planning. A Resiliency Chapter will be in Massport's Strategic Plan to be released this summer. In addition, Massport has been working with consultants to create a Disaster and Infrastructure Resiliency Planning Study (DIRP) to determine short and long term susceptibility to climate-influenced events such as increased storm surges, sea level rise, and extreme precipitation. Based on historical data, future weather and sea level rise projections, they are looking at protecting existing assets at Massport to the level of a Category 2 Hurricane that would hit Boston at Mean High High Water - the highest of the two high tides. (Superstorm Sandy was a Category 1 Hurricane and hit Boston at low tide).

The DIRP Short-term Adaptation Plan will address concerns for climate preparedness over the next 5 years. It will also include recommendations for the longer term – considering how climate may change over the planning horizon of 30 years. The DIRP involves several tasks: conducting a climate hazard and threat analysis to the both the general area and to specific assets, analyzing vulnerability, and creating resiliency action plans based on projections and scenario modeling. The study currently is focusing on Logan and Maritime. Preliminary findings were presented at the March 20, 2014 Massport Board meeting and final findings and reports were due by June 30, 2014. A series of sector-specific facility meetings are currently underway with building managers and operational staff to review and provide input into the consultants' draft recommendations.

The Resiliency Program hopes to create a culture of resiliency thinking at Massport – from an infrastructure as well as operational perspective. As the months unfold we hope to bring in speakers from other airports and ports that have gone through significant and disruptive natural events to share lessons-learned and convene colleagues who are dealing with similar issues for knowledge sharing. The Resiliency Program's goals include: becoming an innovative and national model for resiliency planning and implementation within a port authority; improving our overall infrastructure and operational resilience; increasing our business value and contextual community responsibilities through improved resiliency; engaging our stakeholders to better understand our mutual needs; and incorporating resilience design and construction practices in the development of our airports, maritime systems, and real estate. For further information, please contact the Program Manager of Resiliency, Robbin Peach at rpeach@massport.com.

Household Hazardous Waste Collection-Logan, Worcester & Hanscom Airports

Massport kicked off the 44th annual Earth Day celebration by hosting free household hazardous waste collection events. Massport encouraged employees and tenants to clean their garage, basements, and attics in order to prevent harmful chemicals from making their way into the environment.

This year's events were held at Logan, Hanscom, and Worcester. Massport collected a total of 11,000 pounds of hazardous waste which included paints, pesticides, mercury and flammables and a total of approximately 14,040 pounds of electronic such as computers, monitors, televisions and printers. Thanks to all who participated!

MassDOT Energy Conference

On Tuesday May 13, Massport was invited to participate on a renewable energy panel on behalf of the MassDOT Office of Energy, Technology and Management. This year's theme focused on renewables and energy resiliency in Massachusetts. MassDOT's one-day, three session event invited multi-sector industry leaders and stakeholders to network and join in conversations about current renewable energy topics and solutions. Participants of the Expo where challenged to explore renewable energy projects in the transportation sector and its current renewable technologies.

The Energy Conference also hosted panels throughout the day to update the audience on their company's progress for a better, more resilient transportation system. The renewable energy panel titled "Renewable and Alternative Energy Projects: Challenges and Lessons Learned" addressed perspectives related to Federal and State renewable targets and legislation as well as alternative financing mechanisms for renewable power development and lessons learned from existing renewable installations. The five person panel included Representative John Keenan, Eric Friedman, Director of MA Lead by Example Programs, Oliver Hongyan, DOT Renewable Energy Specialist, Teresa Civic, Massport, Utilities Manager, and Katie Servis, MassDot Aeronautics Division, Aviation Planner. The session highlighted MassDOT's current renewable, green and alternative energy projects. Massport specifically referenced its development of approximately one (1) Megawatt of new renewable installations across its properties and conveyed several lessons learned from early system design, maintenance and operations.

FUN FACTS ABOUT SUSTAINABILITY

Water

- A hot water faucet that leaks one drop per second can add up to 165 gallons a month. That's more than one person use in two weeks.
- An energy-smart clothes washer can save more water in one year than one person drinks in an entire lifetime.
- An automatic dishwasher uses less hot water than doing dishes by hand - an average of six gallons less, or more than 2,000 gallons per year.
- An American family of four uses up to 260 gallons of water in the home per day.
- Running tap water for two minutes is equal to 3-5 gallons of water.
- A 5-minute shower is equal to 20-35 gallons of water.
- A full bath is equal to approximately 60 gallons of water.

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Capital Programs and Environmental Affairs

EnviroNews

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October 2014

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Elementary School Art Contest

Massport's Capital Programs and Environmental Affairs partnered with the Community Relations department to engage 5th graders to challenge themselves in a recycling art contest. The art contest involved Elementary schools from East Boston, South Boston, and Winthrop.

Massport received 21 astonishing images. After reviewing the submittals, four images were chosen as winners. These images exemplify what the students envision when they think about "Recycling", how the future will look if everyone recycled more often and how the earth will benefit from recycling. The winning schools had their images wrapped on a pre-security recycling barrel at each terminal at Logan. Make sure to check them out, take a picture and share it with friends.

Conley Terminal Goes Green With Cleaning Products

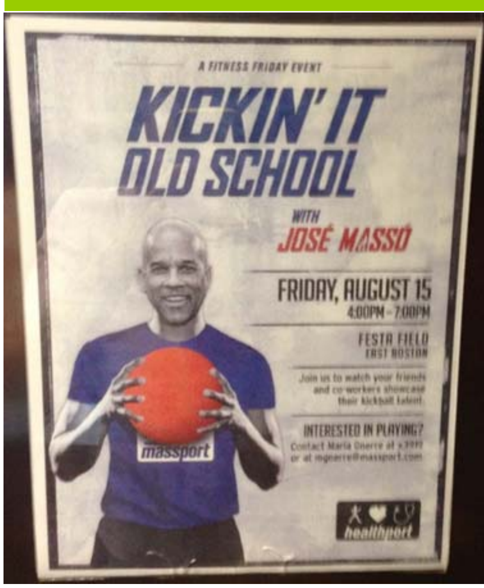
After attending a seminar on Executive Order 515, Massport's Maritime department had a goal to switch to environmentally preferable cleaning products, and eliminate the use of harsh chemical cleaners.

The AccuDose system provides benefits in three main ways:

1. Eliminated the need for 13 different cleaning products and only 5 are required now.
2. The system prevents employees from over-dosing by pre-measuring the amount of chemical needed at the push of a button.
3. Minimized the addition to solid waste stream by eliminating unnecessary bottles. The existing bottles are constantly reused.

This switch has helped to conserve natural resources, reduce waste, safeguard the environment and promote the use of clean technologies.

What do People have to do with Sustainability?



People are the keystone to sustainability at Massport; the success of sustainability efforts at Massport depends on the cooperation and active involvement of the Airport's passengers, employees, tenants, and community organizations. The following examples illustrate just a few ways of how Massport supports the sustainability of its people.

Employees

Massport knows that a dynamic workforce and employee morale are critical to delivering high levels of service. This goes beyond standard benefits, inclusiveness, and training incentives to include the physical health and wellness of individual employees.

As an example, Massport offered Fitbit activity trackers to all employees who participated in an organized walking program. In addition, its "On the Move" program, in partnership with the YMCA of East Boston, includes regularly scheduled on-site fitness classes like yoga, kickboxing, and meditation that take place at the Logan Office Center. Offering these types of programs is just another way Massport strives to enhance employee satisfaction and wellness, which contributes to the overall sustainability of Massport as an organization.

Passengers

Logan is dedicated to providing a superior travel experience that welcomes visitors and provides a convenient and smooth passage for travelers. Some of the notable amenities provided to Logan Airport's visitors include multilingual signs, free Wi-Fi and charging stations, children's play spaces, a chapel, and even several pet relief areas!

One of the latest improvements to the passenger experience at Logan Airport was the renovation of the food court in Terminal E. Beyond upgrades to the shops, eateries, and general amenities, the new area includes the addition of several "Living Walls," which are five-foot-tall sections of wall holding potted plants. The plants symbolize the life that travels through Logan's spaces, and help to purify the air, remove toxins from the environment, and provide sound insulation. The purpose is to provide a calm, healthy, and supportive experience for travelers.

Fire Prevention Week 2014

Did You Know? Here's How Long it Takes for Certain Products to Decompose

- Banana Peel: 3-4 weeks
- Paper Bag: 1 month
- Cardboard: 2 months
- Wool Sock: 1 year
- Tinned Steel Can: 50 years
- Aluminum Can: 200-500 years (But if recycled, it can be reused within 6 weeks!)
- Disposable Diapers: 550 years
- Plastic Bags : 20-1,000 years
- Plastic Jug: 1 million years
- Glass: 1-2 million years
- Styrofoam: 1+ million years

Fire Prevention Week was October 5-11, 2014. It was established to commemorate the Great Chicago Fire in 1871 that killed more than 250 people, left 100,000 homeless, destroyed more than 17,400 structures and burned more than 2,000 acres. The theme of this year's week was, "Smoke Alarms Save Lives: Test Yours Every Month!"

When was the last time you tested the smoke alarms in your home? If you're like many people, you may not even remember. Smoke alarms have become such a common feature of U.S. households that they're often taken for granted. Many smoke detectors aren't tested and maintained as they should.

Working smoke alarms are a critical fire safety tool that can mean the difference between life and death in a home fire. According to the nonprofit National Fire Protection Association (NFPA), smoke alarms can cut the chance of dying in a home fire in half. Meanwhile, NFPA data shows that home fires killed more than 2,300 people in 2012; many of these deaths could have been prevented with the proper smoke alarm protection.

There are many devastating effects of fire; burns, the loss of homes, loss of possessions or worse. It is important that you make sure there are working smoke alarms installed throughout your home. These simple steps can help make a life-saving difference, and prevent the potentially life-threatening impact of fire.

Here are some smoke alarm tips:

- Install smoke alarms in every bedroom, outside each separate sleeping area and on every level of the home, including the basement.
- Interconnect all smoke alarms throughout the home. When one sounds, they all sound.
- Test alarms each month by pushing the test button.
- Replace all smoke alarms, including alarms that use 10-year batteries and hard-wired alarms, when they are 10 year old (or sooner if they do not respond properly).
- Make sure everyone in the home knows the sound and understands what to do when they hear the smoke alarm.

To learn more about the "Working Smoke Alarms Save Lives: Test Yours Every Month!" campaign; visit NFPA's Web site at www.firepreventionweek.org.

Fire Prevention and Cooking

…at Home

U.S. Fire Departments responded to an estimated annual average of 156,600 cooking-related fires between 2007-2011, resulting in 400 civilian deaths, 5,080 civilian injuries and $853 million in direct damage. It is important that you never leave cooking food unattended. Keep loose clothing away from the heat source. Be careful when opening microwaves. Although they don't often cause fires, they are a significant source of scalding burns.

…In Restaurants

In 2012, there were 381 building fires in restaurants and other eating and drinking establishments that caused three civilian and three firefighter injuries and $2.6 million in property damage. Proper maintenance of commercial cooking equipment and extinguishing systems is critical in preventing devastating fires.

<u>Commercial Cooking Operations Requirements for Exhaust Hood Inspections</u>

Commercial cooking exhaust hoods require frequent cleaning and inspection. Grease can build up on the surface of the exhaust hood or in the duct system. Cleaning eliminates that grease and removes the fire hazard.

Dirty Hood

Clean Hood

<u>Fire Suppression Systems for Commercial Cooking Operations</u>

Fixed Extinguishing Systems 527 CMR 11.00, NFPA 96 states that cooking that produces grease-laden vapors are required to have a fixed extinguishing system. These systems are required to be inspected periodically by a licensed company.

Commercial Fire Suppression System

If you have any questions about fire prevention, required fire safety equipment or inspections please contact Assistant Fire Chief Gerald "Jay" Drumm of the Massport Fire Rescue Department at 617-561-3415 or at GDrumm@massport.com.

Questions about Environmental/Safety Issues

Who should you contact?

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EMS/Sustainability		
Jacob Glickel	(617) 568-3558	jglickel@massport.com

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2014 Peak Period Pricing Monitoring Report

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BOSTON-LOGAN INTERNATIONAL AIRPORT MONITORING REPORT ON SCHEDULED AND NON-SCHEDULED FLIGHT ACTIVITY

Peak Period Surcharge Regulation
740 CMR 27:00: Massachusetts Port Authority

Report Number:	**011**
Monitoring Period:	**Through Sept. 2014**
Report Issue Date:	**June 2014**

<u>Note</u>: This report reflects the Boston-Logan Airport flight activity monitoring under 740 CMR 27.03 Peak Period Surcharge Regulation on Aircraft Operations at Boston-Logan International Airport.

<u>Findings</u>: This report includes actual and projected activity data **<u>through September 2014</u>**. Current and projected near-term flight levels at Boston Logan are well below Logan's good weather (VFR) throughput of approximately 120 flights per hour. **As a result, average VFR delays are projected to be minimal and well below the 15 minutes threshold through September 2014.**

In the event demand conditions at the airport change significantly from the current projection, Massport will issue updates to this report.

<u>Attachments</u>

Table 1: Summary Overview of Peak Period Surcharge Program

Table 2: Summary Overview of Forecast Methodology

Table 3: Projected Aircraft Operations at Logan Airport Projected

Table 4: Projected Hourly Operations, Average Weekday

Table 5: Forecast Logan Average Weekday Operations

<u>Massport Contact:</u>

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Deputy Director, Aviation Planning and Strategy
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Table 1: Summary Overview of Peak Period Surcharge Program

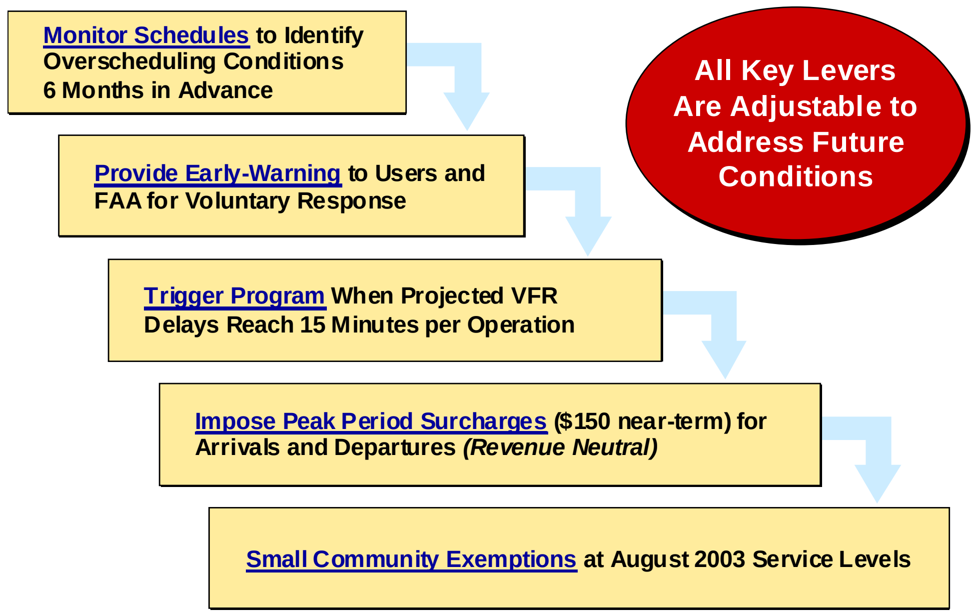
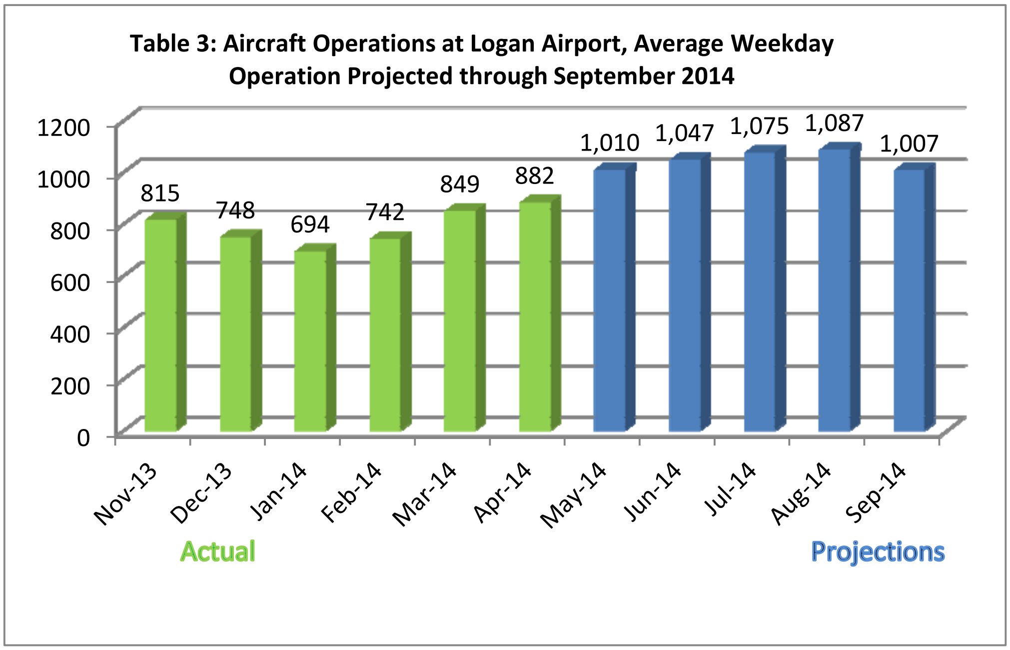


Table 2: Summary Overview of Forecast Methodology

- Scheduled passenger airline flights represent more than 93 percent of total aircraft operations. Passenger airline activity for the Spring and Summer periods were projected based on published advance airline schedules
- Forecasts of monthly activity for other segments (GA, Cargo, Charter) are based on the past three months of actual flight volume and historic patterns of monthly seasonality
- Day-of-week and time of day distributions for non-scheduled segments are based on analysis of Logan radar data
- Projections for each segment were combined to produce the forecast pattern of hourly flight activity for an average weekday, Saturday, and Sunday for the period from February through September

Table 3: Aircraft Operations at Logan Airport, *Average Weekday Operations Projected Through September*



Actual	Projections

Note: Actual Operations are based on Massport data/air carrier reports and reflect flight cancellations due to weather and other operational impacts.

Table 4: Projected Hourly Operations, *Average Weekday, August*

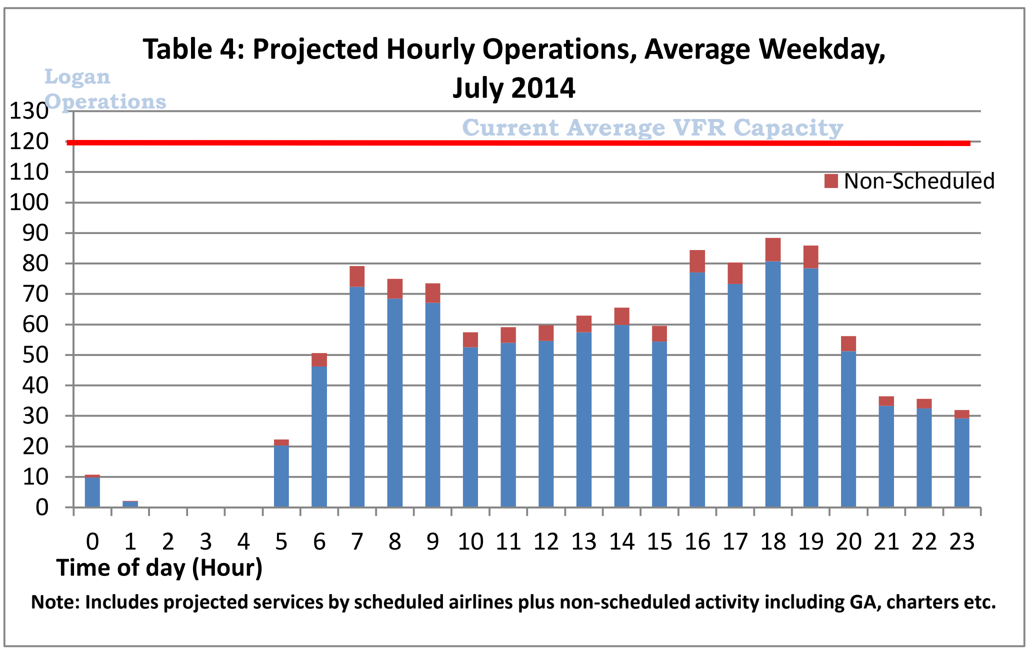


Table 5: Forecast Logan Average Weekday Operations, *Feb. – Sep.*

Forecast Daily Operations								
Hour Range	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
0	9	12	13	10	9	10	8	6
1	2	2	3	2	3	2	2	1
2	1	0	1	0	1	0	0	0
3	0	0	0	0	0	0	0	0
4	1	2	1	0	0	0	0	0
5	8	9	11	15	18	20	18	12
6	35	42	45	47	48	46	46	47
7	45	53	56	67	72	72	74	68
8	46	49	55	65	66	68	68	63
9	48	53	53	60	64	67	69	59
10	43	49	49	48	49	52	51	47
11	40	44	47	55	56	54	57	58
12	32	38	43	59	55	55	57	56
13	33	41	46	48	53	57	57	54
14	36	46	44	56	57	60	61	55
15	40	50	49	51	54	54	59	60
16	46	54	54	70	75	77	76	66
17	49	56	56	76	69	73	77	80
18	52	56	57	81	84	81	81	76
19	50	57	58	64	71	78	77	66
20	46	47	49	47	50	51	53	46
21	35	37	38	34	33	33	36	35
22	25	28	29	31	32	32	34	30
23	20	24	24	24	29	29	27	22
Total	**742**	**849**	**882**	**1,010**	**1,047**	**1,075**	**1,087**	**1,007**

February - April are actual data

May - September is forecast data

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Reduced/Single Engine Taxiing at Logan Airport Memorandum

This Appendix provides detailed information in support of *Chapter 7, Air Quality/ Emissions Reduction:*

- Memorandum from Edward C. Freni, Massport Director of Aviation, to the Boston Logan Airline Committee, Regarding Single/Reduced Engine Taxiing at Boston Logan, Dated May 8, 2014
- Memorandum from Edward C. Freni, Massport Director of Aviation, to the Boston Logan Airline Committee, Regarding Single/Reduced-Engine Taxiing and the Use of Idle Reverse Thrust as Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan, Dated May 4, 2015
- Simaiakis, I, Khadilkar, H., Balakrishnan, H., Reynolds, T.G., Hansman, R.J., Reilly, B., and Urlass, S. "Demonstration of Reduced Airport Congestion Through Pushback Rate Control." *Ninth USA/Europe Air Traffic Management Research and Development Seminar (ATM2011)*.

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To: Boston Logan Air Carriers, Chief Pilots

From: Edward C. Freni
Director of Aviation

Date: May 8, 2014

RE: Single/Reduced-Engine Taxiing and the Use of Idle Reverse Thrust as Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan

As an important user of Boston-Logan International Airport ("Boston Logan"), you are essential to our efforts to ensure that Boston Logan is the safest, most dependable and environmentally responsible airport it can be. Working together, we have successfully implemented safety technologies and new airside facilities at Boston Logan. Our partnership with the air carriers, the FAA, and aviation industry organizations continues with the full, successful implementation of ADSB transponder technology to enhance situational awareness of ground vehicle drivers on the airfield. As you know, ADSB is the FAA's surveillance backbone for NextGen and Boston Logan, with your support, has been one of the key test beds for the FAA. Under a joint partnership with the FAA Technical Center, we are also testing FOD detection technology on runway 9/27 using video and radar to automatically detect and alert for FOD. This array was installed last fall and is now fully operational.

Our success in implementing physical and technological improvements and conducting cutting-edge safety research at Boston Logan is based, in part, on continuing to evaluate and promote operational measures with the potential to reduce environmental impacts from various landside and airside operations. Two such important operational measures that have been identified are single/reduced- engine taxiing and the use of idle-reverse thrust.

I have written to you before to encourage your use of single-engine taxiing when operationally appropriate and consistent with your safety procedures. Based on our outreach to the air carrier community serving Boston Logan and survey information, it is clear that single- or reduced-engine taxiing is being voluntarily utilized by the vast majority of air carriers at Boston Logan. I write to you again to encourage continued use of this fuel saving and emissions reduction strategy subject to pilot discretion and consistent with air carrier operating safety procedures.

I also encourage your use of idle reverse thrust (or minimize the use of reverse thrust) on landing, as a second operational measure, again, only at the discretion of the pilot and when consistent with air carrier operational safety procedures. This measure would provide noise relief to our closest neighbors and, at the same time, provide companion benefits to you, such as reducing fuel burn and engine wear. Clearly, the use of this procedure must also be consistent with operational conditions at Boston Logan, including runway surface conditions, whether LAHSO is in use, and acceptable runway occupancy time.

I encourage you to share this letter with your flight crews and I thank you for the continued work with Massport on enhancing Boston Logan's operational safety and efficiency while improving its environmental footprint. If you have any questions or would like to discuss any aspect of this letter, please feel free to contact me or Mr. Flavio Leo, Deputy Director of Planning and Strategy, at 617-568-3528.

Edward C. Freni
Director of Aviation

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TO: Boston Logan Air Carriers, Chief Pilots

FROM: Edward C. Freni
Director of Aviation

DATE: May 4, 2015

RE: Single/Reduced-Engine Taxiing and the Use of Idle Reverse Thrust as Strategies to Reduce Aircraft-Generated Emissions and Noise at Boston Logan

As an important user of Boston-Logan International Airport ("Boston Logan"), you are an essential partner in our efforts to ensure that Boston Logan operates in the safest, most dependable and environmentally responsible manner possible. Working together, we have successfully implemented many safety technologies and airfield improvements at Boston Logan and we look forward to continuing these collaborative relationships.

Our success in implementing physical and technological improvements and conducting cutting-edge safety research at Boston Logan is based, in part, on continuing to evaluate and promote operational measures with the potential to reduce environmental impacts from various landside and airside operations. Two important operational measures that have been identified are single/reduced-engine taxiing and the use of idle-reverse thrust.

Based on our outreach to the air carrier community serving Boston Logan and survey information, it is clear that single- or reduced-engine taxiing is being voluntarily utilized by the vast majority of air carriers at Boston Logan. I write to you again to encourage your continued use of this fuel saving and emissions reduction strategy subject to pilot discretion and consistent with air carrier operating safety procedures.

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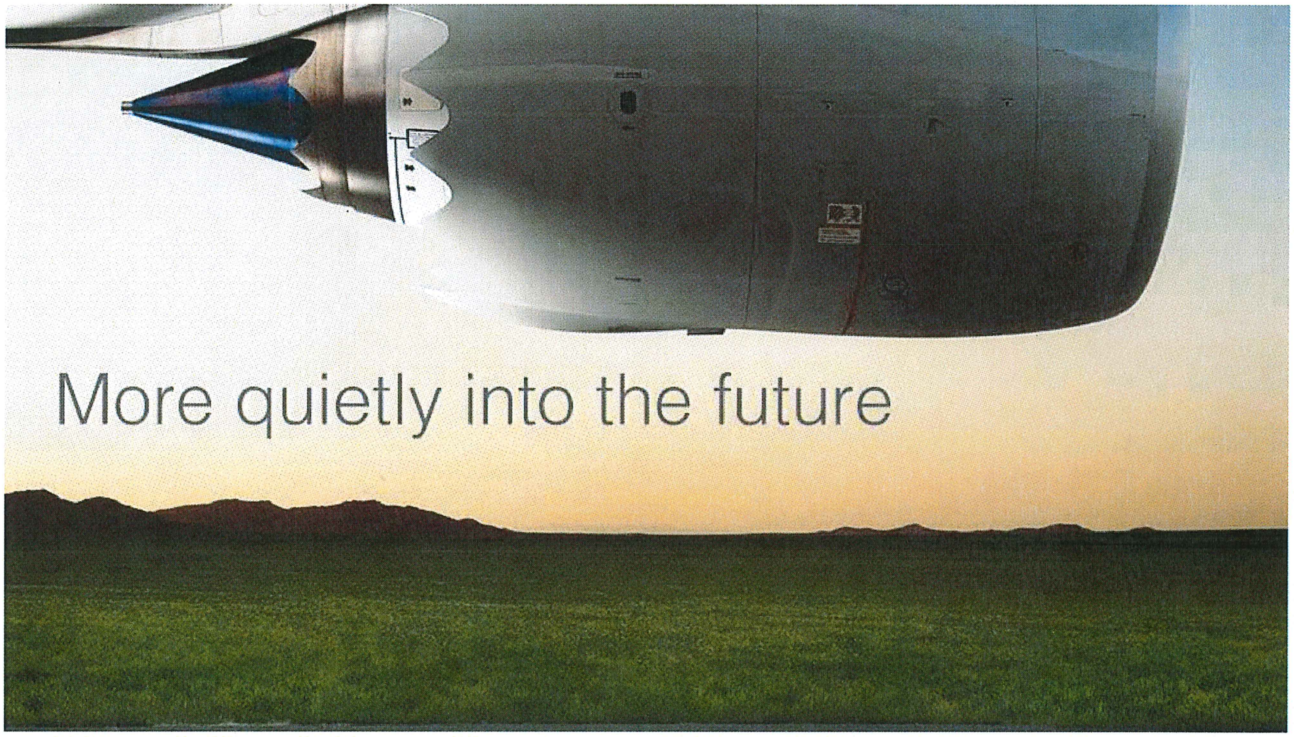
On a related note, I want to share with you information regarding recent industry efforts to retrofit A320 aircraft with "vortex generators" to reduce aircraft noise. Although the A320 is a fully compliant/modern aircraft, this is an excellent

example of additional, incremental actions we can take as an industry to reduce operational impacts on the environment. Attached please find more information related to this technology.

I encourage you to share this letter with your flight crews and thank you for your continued work to enhance Boston Logan's operational safety and efficiency, while improving its environmental footprint. If you have any questions or would like to discuss any aspect of this letter, please feel free to contact me or Mr. Flavio Leo, Deputy Director of Planning and Strategy, at 617-568-3528.

Edward C. Freni
Director of Aviation



Retrofitting the existing fleet

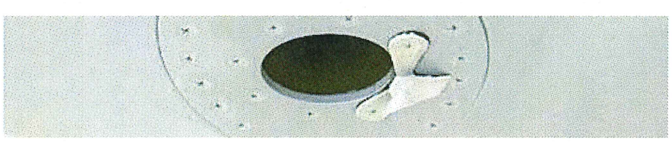
The Lufthansa Group is also retrofitting older aircraft in its fleet with noise-reducing technologies. In this connection the Group is working closely with the German Aerospace Center (DLR) and the various aircraft manufacturers.

Lufthansa is retrofitting more than 200 aircraft with vortex generators so that they will fly more quietly in the future.

In February 2014 Lufthansa became the first airline in the world to take delivery of an Airbus A320 equipped with vortex generators. A total of 157 aircraft in the existing fleet will be equipped with the new noise-reducing component, so that, when the expected new deliveries are added in, more than 200 A320 aircraft in total will be flying more quietly. As result, every second Lufthansa landing in Frankfurt and one in three in Munich will become audibly quieter. Overfly measurements revealed that the vortex generators are able to eliminate two unpleasant tones and thereby lower the aircraft's total noise level on approach by up to four decibels at distances between 17 and 10 kilometers from the runway. Thus the Lufthansa Group has realized a key objective of the "Alliance for More Noise Protection", a joint initiative of the Lufthansa Group, Fraport, the airline association BARIG, DFS, the Airport and Region Forum (FFR), and the government of the State of Hesse.

A320 audio tests

A320 audio tests with and without vortex generators on the **final approach at Frankfurt Airport** from the Offenbach-Lauterborn monitoring point



Further information

Refitting existing aircraft

→ Active noise protection – More than 200 Lufthansa Airbus A320 aircraft will become quieter from February 2014

Video: Active noise protection at Frankfurt Airport

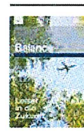
→ Retrofitting of the Boeing 737 fleet

Press Releases

29.10.13

→ Lufthansa to make majority of short-haul aircraft quieter

Sustainability Report



To find out more about responsibility within the Lufthansa Group, read the latest sustainability report Balance (E-Paper).

Order or download the report.

Weitersagen

More Themes

→ Overview

Without vortex generators **With vortex generators**

A320 audio tests with and without vortex generators on the **final approach at Munich Airport** from the Massenhausen monitoring point

Without vortex generators **With vortex generators**

Demonstration of Reduced Airport Congestion Through Pushback Rate Control

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***Abstract*—Airport surface congestion results in significant increases in taxi times, fuel burn and emissions at major airports. This paper describes the field tests of a congestion control strategy at Boston Logan International Airport. The approach determines a suggested rate to meter pushbacks from the gate, in order to prevent the airport surface from entering congested states and to reduce the time that flights spend with engines on while taxiing to the runway. The field trials demonstrated that significant benefits were achievable through such a strategy: during eight four-hour tests conducted during August and September 2010, fuel use was reduced by an estimated 12,000-15,000 kg (3,900-4,900 US gallons), while aircraft gate pushback times were increased by an average of only 4.3 minutes for the 247 flights that were held at the gate.**

Keywords- departure management, pushback rate control, airport congestion control, field tests

I. Introduction

Aircraft taxiing on the surface contribute significantly to the fuel burn and emissions at airports. The quantities of fuel burned, as well as different pollutants such as Carbon Dioxide, Hydrocarbons, Nitrogen Oxides, Sulfur Oxides and Particulate Matter, are proportional to the taxi times of aircraft, as well as other factors such as the throttle settings, number of engines that are powered, and pilot and airline decisions regarding engine shutdowns during delays.

Airport surface congestion at major airports in the United States is responsible for increased taxi-out times, fuel burn and emissions [1]. Similar trends have been noted in Europe, where it is estimated that aircraft spend 10-30% of their flight time taxiing, and that a short/medium range A320 expends as much as 5-10% of its fuel on the ground [2]. Domestic flights in the United States emit about 6 million metric tonnes of CO_2, 45,000 tonnes of CO, 8,000 tonnes of NOx, and 4,000 tonnes of HC taxiing out for takeoff; almost half of these emissions are at the 20 most congested airports in the country. The purpose of the Pushback Rate Control Demonstration at Boston Logan International Airport (BOS) was to show that a significant portion of these impacts could be reduced through measures to limit surface congestion.

This work was supported by the Federal Aviation Administration's Office of Environment and Energy through MIT Lincoln Laboratory and the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER).

A simple airport congestion control strategy would be a state-dependent pushback policy aimed at reducing congestion on the ground. The *N-control* strategy is one such approach, and was first considered in the Departure Planner project [3]. Several variants of this policy have been studied in prior literature [4, 5, 6, 7]. The policy, as studied in these papers, is effectively a simple threshold heuristic: if the total number of departing aircraft on the ground exceeds a certain threshold, further pushbacks are stopped until the number of aircraft on the ground drops below the threshold. By contrast, the *pushback rate control* strategy presented in this paper does not stop pushbacks once the surface is in a congested state; instead it regulates the rate at which aircraft pushback from their gates during high departure demand periods so that the airport does not reach undesirable highly congested states.

A. Motivation: Departure throughput analysis

The main motivation for our proposed approach to reduce taxi times is an observation of the performance of the departure throughput of airports. As more aircraft pushback from their gates onto the taxiway system, the throughput of the departure runway initially increases because more aircraft are available in the departure queue. However, as this number, denoted N, exceeds a threshold, the departure runway capacity becomes the limiting factor, and there is no additional increase in throughput. We denote this threshold as N^*. This behavior can be further parameterized by the number of arrivals. The dependence of the departure throughput on the number of aircraft taxiing out and the arrival rate is illustrated for one runway configuration in Figure 1 using 2007 data from FAA's Aviation System Performance Metrics (ASPM) database. Beyond the threshold N^*, any additional aircraft that pushback simply increase their taxi-out times [8]. The value of N^* depends on the airport, arrival demand, runway configuration, and meteorological conditions. During periods of high demand, the pushback rate control protocol regulates pushbacks from the gates so that the number of aircraft taxiing out stays close to a specified value, N_{ctrl}, where $N_{\text{ctrl}} > N^*$, thereby ensuring that the airport does not reach highly-congested states. While the choice of N_{ctrl} must be large enough to maintain runway utilization, too large a value will be overly conservative, and result in a loss of benefit from the control strategy.

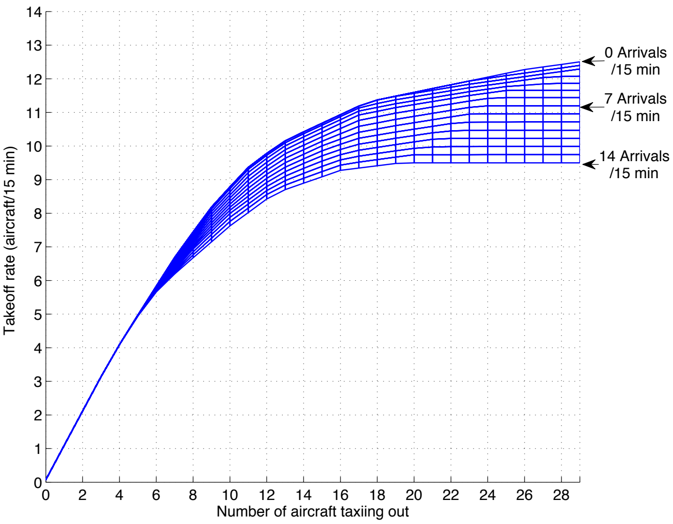

Fig. 1: Regression of the departure throughput as a function of the number of aircraft taxiing out, parameterized by the arrival rate for 22L, 27 | 22L, 22R configuration, under VMC [9].

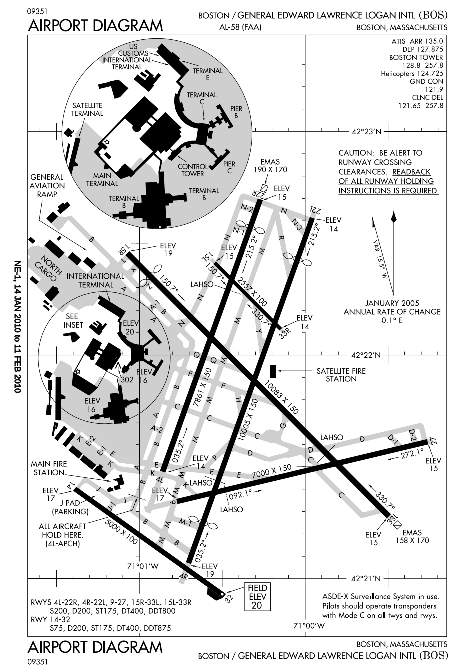

Fig. 2: BOS airport diagram, showing alignment of runways.

II. DESIGN OF THE PUSHBACK RATE CONTROL PROTOCOL

The main design consideration in developing the pushback rate control protocol was to incorporate effective control techniques into current operational procedures with minimal additional controller workload and procedural modifications. After discussions with the BOS facility, it was decided that suggesting a rate of pushbacks (to the BOS Gate controller) for each 15-min period was an effective strategy that was amenable to current procedures.

The two important parameters that need to be estimated in order to determine a robust control strategy are the N^* threshold and the departure throughput of the airport for different values of N. These parameters can potentially vary depending on meteorological conditions, runway configuration and arrival demand (as seen in Figure 1), but also on the fleet mix and the data sources we use.

A. Runway configurations

BOS experiences Visual Meteorological Conditions (VMC) most of the time (over 83% of the time in 2007). It has a complicated runway layout consisting of six runways, five of which intersect with at least one other runway, as shown in Figure 2. As a result, there are numerous possible runway configurations: in 2007, 61 different configurations were reported. The most frequently-used configurations under VMC are 22L, 27 | 22L, 22R; 4L, 4R | 4L, 4R, 9; and 27, 32 | 33L, where the notation 'R1, R2 | R3, R4' denotes arrivals on runways R1 and R2, and departures on R3 and R4. The above configurations accounted for about 70% of times under VMC.

We note that, of these frequently used configurations, 27, 32 | 33L involves taxiing out aircraft across active runways. Due to construction on taxiway "November" between runways 15L and 22R throughout the duration of the demo, departures headed to 22R used 15L to cross runway 22R onto taxiway "Mike". This resulted in departing aircraft crossing active runways in the 27, 22L | 22L, 22R configuration as well.

During our observations prior to the field tests as well as during the demo periods, we found that under Instrument Meteorological Conditions (IMC), arrivals into BOS are typically metered at the rate of 8 aircraft per 15 minutes by the TRACON. This results in a rather small departure demand, and there was rarely congestion under IMC at Boston during the evening departure push. For this reason, we focus on configurations most frequently used during VMC operations for the control policy design.

B. Fleet mix

Qualitative observations at BOS suggest that the departure throughput is significantly affected by the number of propeller-powered aircraft (props) in the departure fleet mix. In order to determine the effect of props, we analyze the tradeoff between takeoff and landing rates at BOS, parameterized by the number of props during periods of high departure demand.

Figure 3 shows that under Visual Meteorological Conditions (VMC), the number of props has a significant impact on the departure throughput, resulting in an increase at a rate of nearly one per 15 minutes for each additional prop departure. This observation is consistent with procedures at BOS, since air traffic controllers fan out props in between jet departures, and therefore the departure of a prop does not significantly interfere with jet departures. The main implication of this observation for the control strategy design at BOS was that props could be exempt from both the pushback control as well as the counts of aircraft taxiing out (N). Similar analysis also shows that heavy departures at BOS do not have a significant

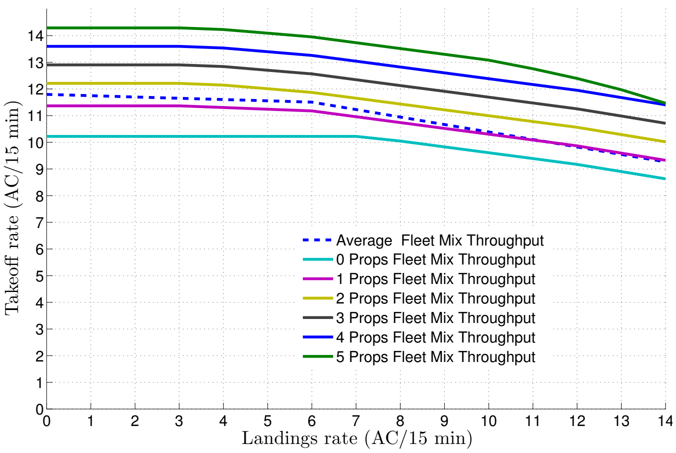

Fig. 3: Regression of the takeoff rate as a function of the landing rate, parameterized by the number of props in a 15-minute interval for 22L, 27 | 22L, 22R configuration, under VMC [9].

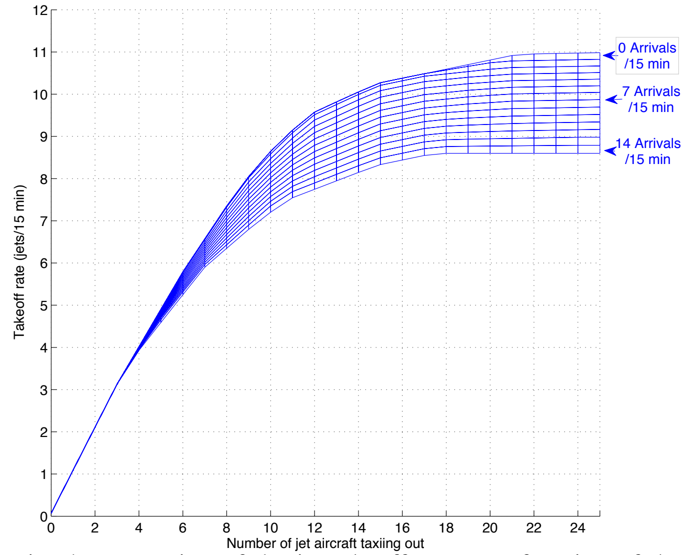

Fig. 4: Regression of the jet takeoff rate as a function of the number of departing jets on the ground, parameterized by the number of arrivals for 22L, 27 | 22L, 22R configuration, under VMC [9].

impact on departure throughput, in spite of the increased wake-vortex separation that is required behind heavy weight category aircraft. This can be explained by the observation that air traffic controllers at BOS use the high wake vortex separation requirement between a heavy and a subsequent departure to conduct runway crossings, thereby mitigating the adverse impact of heavy weight category departures [9].

Motivated by this finding, we can determine the dependence of the jet (i.e., non-prop) departure throughput as a function of the number of jet aircraft taxiing out, parameterized by the number of arrivals, as illustrated in Figure 4. This figure illustrates that during periods in which arrival demand is high, the jet departure throughput saturates when the number of jets taxiing out exceeds 17 (based on ASPM data).

C. Data sources

It is important to note that Figure 1, Figure 3 and Figure 4 are determined using ASPM data. Pushback times in ASPM are determined from the brake release times reported through the ACARS system, and are prone to error because about 40% of the flights departing from BOS do not automatically report these times [10]. Another potential source of pushback and takeoff times is the Airport Surface Detection Equipment Model X (or ASDE-X) system, which combines data from airport surface radars, multilateration sensors, ADS-B, and aircraft transponders [11]. While the ASDE-X data is likely to be more accurate than the ASPM data, it is still noisy, due to factors such as late transponder capture (the ASDE-X tracks only begin after the pilot has turned on the transponder, which may be before or after the actual pushback time), aborted takeoffs (which have multiple departure times detected), flights cancelled after pushback, etc. A comparison of both ASDE-X and ASPM records with live observations made in the tower on August 26, 2010 revealed that the average difference between the number of pushbacks per 15-minutes as recorded by ASDE-X and by visual means is 0.42, while it is -3.25 for ASPM and visual observations, showing that the ASPM records differ considerably from ASDE-X and live observations. The above comparison motivates the recalibration of airport performance curves and parameters using ASDE-X data in addition to ASPM data. This is because ASPM data is not available in real-time and will therefore not be available for use in real-time deployments, and the ASDE-X data is in much closer agreement to the visual observations than ASPM.

We therefore conduct similar analysis to that shown in Figure 4, using ASDE-X data. The results are shown in Figure 5. We note that the qualitative behavior of the system is similar to what was seen with ASPM data, namely, the jet throughput of the departure runway initially increases because more jet aircraft are available in the departure queue, but as this number exceeds a threshold, the departure runway capacity becomes the limiting factor, and there is no additional increase in throughput. By statistically analyzing three months of ASDE-X data from Boston Logan airport using the methodology outlined in [9], we determine that the average number of active jet departures on the ground at which the surface saturates is 12 jet aircraft for the 22L, 27 | 22L, 22R configuration, during periods of moderate arrival demand. This value is close to that deduced from Figure 5, using visual means.

D. Estimates of N^*

Table I shows the values of N^* for the three main runway configurations under VMC, that were used during the field tests based on the ASDE-X data analysis. For each runway configuration, we use plots similar to Figure 5 to determine the expected throughput. For example, if the runway configuration is 22L, 27 | 22L, 22R, 11 jets are taxiing out, and the expected arrival rate is 9 aircraft in the next 15 minutes, the expected departure throughput is 10 aircraft in the next 15 minutes.

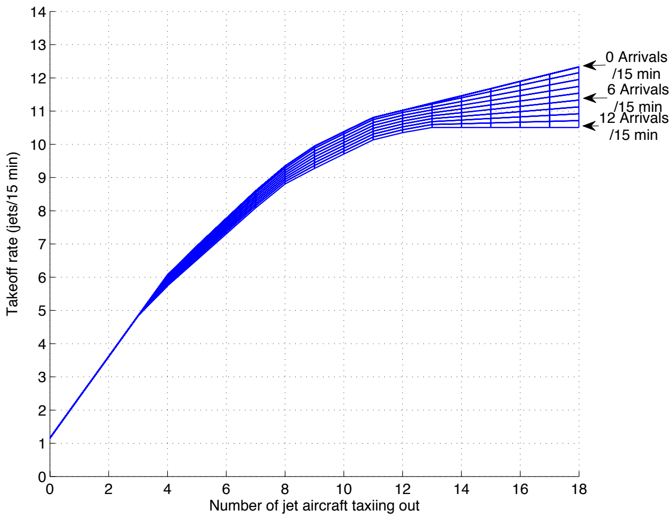

Fig. 5: Regression of the takeoff rate as a function of the number of jets taxiing out, parameterized by the number of arrivals, using ASDE-X data, for the 22L, 27 | 22L, 22R configuration.

III. Implementation of Pushback Rate Control

The pushback rate was determined so as to keep the number of jets taxiing out near a suitable value (N_{ctrl}), where N_{ctrl} is greater than N^*, in order to mitigate risks such as under-utilizing the runway, facing many gate conflicts, or being unable to meet target departure times. Off-nominal events such as gate-use conflicts and target departure times were carefully monitored and addressed. Figure 6 shows a schematic of the decision process to determine the suggested pushback rate.

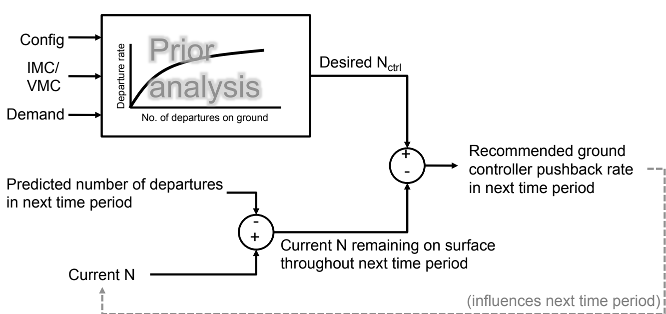

Fig. 6: A schematic of the pushback rate calculation.

The determination of the pushback rate is conducted as follows. Prior to the start of each 15-minute period, we:

1) Observe the operating configuration, VMC/IMC, and the predicted number of arrivals in the next 15 minutes (from ETMS) and using these as inputs into the appropriate departure throughput saturation curves (such as Figure 5), determine the expected jet departure throughput.
2) Using visual observations, count the number of departing jets currently active on the surface. We counted a departure as active once the pushback tug was attached to the aircraft and it was in the process of pushing back.
3) Calculate the difference between the current number of active jet departures and the expected jet departure throughput. This difference is the number of currently active jets that are expected to remain on the ground through the next 15 min.
4) The difference between N_{ctrl} and the result of the previous step provides us with the additional number of pushbacks to recommend in next 15 minutes.
5) Translate the suggested number of pushbacks in the next 15 minutes to an approximate pushback rate in a shorter time interval more appropriate for operational implementation (for example, 10 aircraft in the next 15 minutes would translate to a rate of "2 per 3 minutes.").

TABLE I
VALUES OF N^* ESTIMATED FROM THE ANALYSIS OF ASDE-X DATA.

Configuration	N^*
22L, 27 | 22L, 22R	12
27, 32 | 33L	12
4L, 4R | 4L, 4R, 9	15

A. Communication of recommended pushback rates and gate-hold times

During the demo, we used color-coded cards to communicate suggested pushback rates to the air traffic controllers, thereby eliminating the need for verbal communications. We used one of eight 5 in × 7.5 in cards, with pushback rate suggestions that ranged from "1 per 3 minutes" (5 in 15 minutes) to "1 aircraft per minute" (15 in 15 minutes), in addition to "Stop" (zero rate) and "No restriction" cards, as shown in Figure 7 (left). The setup of the suggested rate card in the Boston Gate controllers position is shown in Figure 7 (right).

Fig. 7: (Left) Color-coded cards that were used to communicate the suggested pushback rates. (Right) Display of the color-coded card in the Boston Gate controller's position.

The standard format of the gate-hold instruction communicated by the Boston Gate controller to the pilots included both the current time, the length of the gate-hold, and the time at which the pilot could expect to be cleared. For example:
Boston Gate: "AAL123, please hold push for 3 min. Time is now 2332, expect clearance at 2335. Remain on my frequency, I will contact you."

In this manner, pilots were made aware of the expected gate-holds, and could inform the controller of constraints such as gate conflicts due to incoming aircraft. In addition, ground crews could be informed of the expected gate-hold time, so that they could be ready when push clearance was given. The post-analysis of the tapes of controller-pilot communications showed that the controllers cleared aircraft for push at the times they had initially stated (i.e., an aircraft told to expect to push at 2335 would indeed be cleared to push at 2335), and that they also accurately implemented the push rates suggested by the cards.

B. Handling of off-nominal events

The implementation plan also called for careful monitoring of off-nominal events and system constraints. Of particular concern were gate conflicts (for example, an arriving aircraft is assigned a gate at which a departure is being held), and the ability to meet controlled departure times (Expected Departure Clearance Times or EDCTs) and other constraints from Traffic Management Initiatives. After discussions with the Tower and airlines prior to the field tests, the following decisions were made:

1) Flights with EDCTs would be handled as usual and released First-Come-First-Served. Long delays would continue to be absorbed in the standard holding areas. Flights with EDCTs did not count toward the count of active jets when they pushed back; they counted toward the 15-minute interval in which their departure time fell. An analysis of EDCTs from flight strips showed that the ability to meet the EDCTs was not impacted during the field tests.
2) Pushbacks would be expedited to allow arrivals to use the gate if needed. Simulations conducted prior to the field tests predicted that gate-conflicts would be relatively infrequent at BOS; there were only two reported cases of potential gate-conflicts during the field tests, and in both cases, the departures were immediately released from the gate-hold and allowed to pushback.

C. Determination of the time period for the field trials

The pushback rate control protocol was tested in select evening departure push periods (4-8PM) at BOS between August 23 and September 24, 2010. Figure 8 shows the average number of departures on the ground in each 15-minute interval using ASPM data. There are two main departure pushes each day. The evening departure push differs from the morning one because of the larger arrival demand in the evenings. The morning departure push presents different challenges, such as a large number of flights with controlled departure times, and a large number of tow-ins for the first flights of the day.

IV. Results of field tests

Although the pushback rate control strategy was tested at BOS during 16 demo periods, there was very little need to control pushbacks when the airport operated in its most

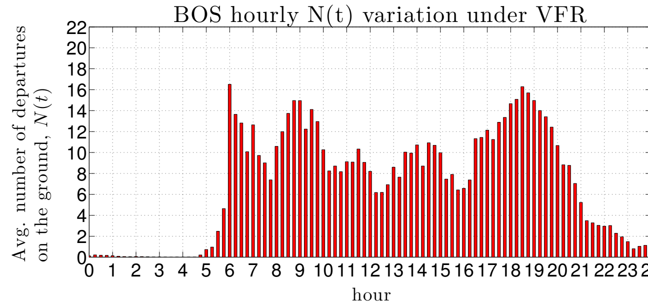

Fig. 8: Variation of departure demand (average number of active departures on the ground) as a function of the time of day.

efficient configuration (4L, 4R | 4L, 4R, 9), and in only eight of the demo periods was there enough congestion for gate-holds to be experienced. There was insufficient congestion for recommending restricted pushback rates on August 23, September 16, 19, 23, and 24. In addition, on September 3 and 12, there were no gate-holds (although departure demand was high, traffic did not build up, and no aircraft needed to be held at the gate). For the same reason, only one aircraft received a gate-hold of 2 min on September 17. The airport operated in the 4L, 4R | 4L, 4R, 9 configuration on all three of these days. In total, pushback rate control was in effect during the field tests for over 37 hours, with about 24 hours of test periods with significant gate-holds.

A. Data analysis examples

In this section, we examine three days with significant gate-holds (August 26, September 2 and 10) in order to describe the basic features of the pushback rate control strategy.

Figure 9 shows taxi-out times from one of the test periods, September 2. Each green bar in Figure 9 represents the actual taxi-out time of a flight (measured using ASDE-X as the duration between the time when the transponder was turned on and the wheels-off time). The red bar represents the gate-hold time of the flight (shown as a negative number). In practice, there is a delay between the time the tug pushes them from the gate and the time their transponder is turned on, but statistical analysis showed that this delay was random, similarly distributed for flights with and without gate-holds, and typically about 4 minutes. We note in Figure 9 that as flights start incurring gate-holds (corresponding to flights departing at around 1900 hours), there is a corresponding decrease in the active taxi-out times, i.e., the green lines. Visually, we notice that as the length of the gate-hold (red bar) increases, the length of the taxi-out time (green bar) proportionately decreases. There are still a few flights with large taxi-out times, but these typically correspond to flights with EDCTs. These delays were handled as in normal operations (i.e., their gate-hold times were not increased), as was agreed with the tower and airlines. Finally, there are also a few flights with no gate-holds and very short taxi-out times, typically corresponding to props.

The impact of the pushback rate control strategy can be further visualized by using ASDE-X data, as can be seen in

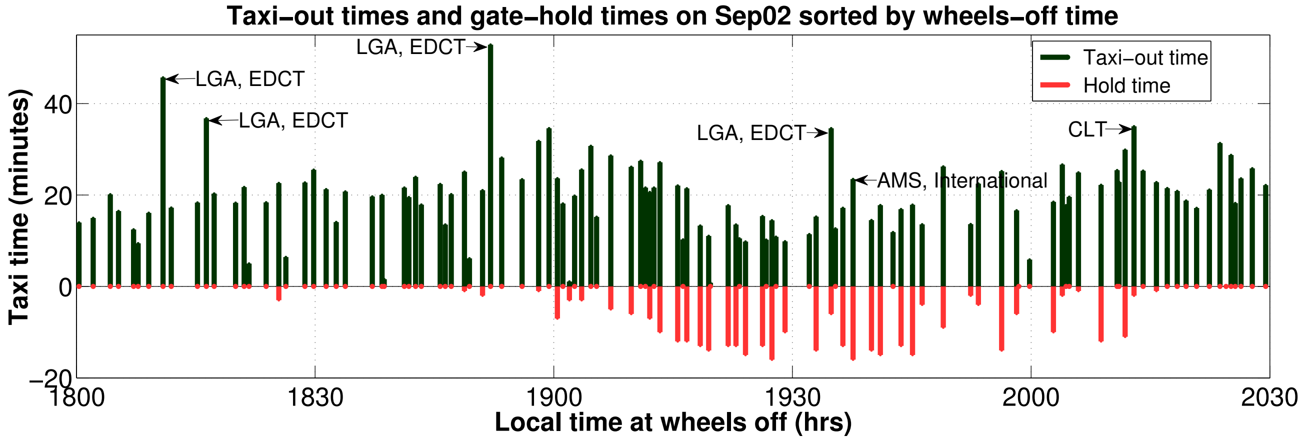

Fig. 9: Taxi-out and gate-hold times from the field test on September 2, 2010.

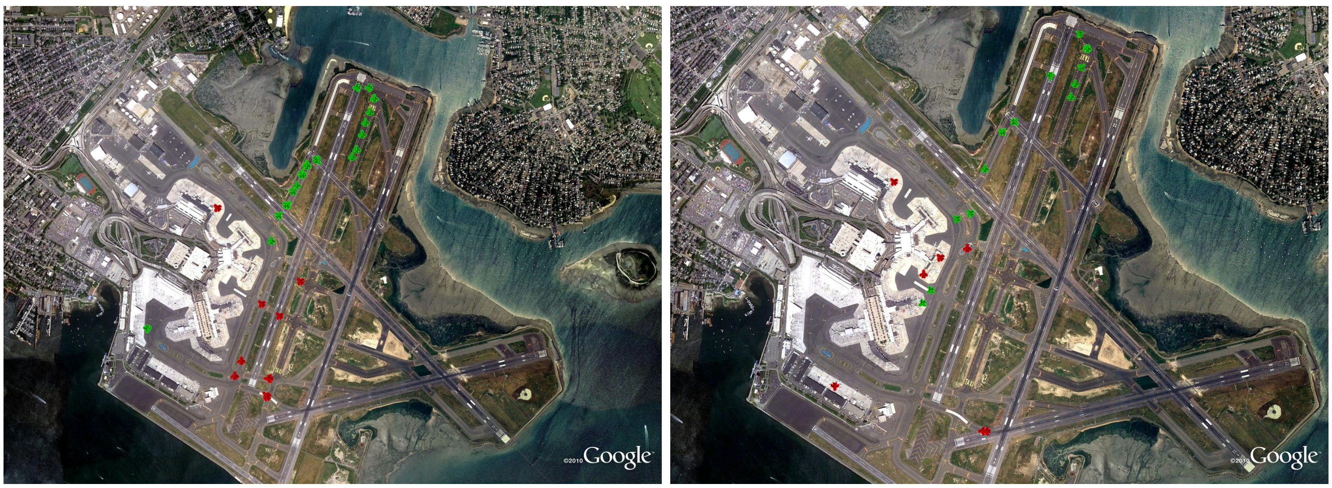

Fig. 10: Snapshots of the airport surface, (left) before gate-holds started, and (right) during gate-holding. Departing aircraft are shown in green, and arrivals in red. We note that the line of 15 departures between the ramp area and the departure runway prior to commencement of pushback rate control reduces to 8 departures with gate-holds. The white area on the taxiway near the top of the images indicates the closed portion of taxiway "November".

the Figure 10, which shows snapshots of the airport surface at two instants of time, the first before the gate-holds started, and the second during the gate-holds. We notice the significant decrease in taxiway congestion, in particular the long line of aircraft between the ramp area and the departure runway, due to the activation of the pushback rate control strategy.

Looking at another day of trials with a different runway configuration, Figure 11 shows taxi-out times from the test period of September 10. In this plot, the flights are sorted by pushback time. We note that as flights start incurring gate-holds, their taxi time stabilizes at around 20 minutes. This is especially evident during the primary departure push between 1830 and 1930 hours. The gate-hold times fluctuate from 1-2 minutes up to 9 minutes, but the taxi-times stabilize as the number of aircraft on the ground stabilizes to the specified N_{ctrl} value. Finally, the flights that pushback between 1930 and 2000 hours are at the end of the departure push and derive the most benefit from the pushback rate control strategy: they have longer gate holds, waiting for the queue to drain and then taxi to the runway facing a gradually diminishing queue.

Figure 12 further illustrates the benefits of the pushback rate control protocol, by comparing operations from a day with pushback rate control (shown in blue) and a day without it (shown in red), under similar demand and configuration. The upper plot shows the average number of jets taxiing-out, and the lower plot the corresponding average taxi-out time, per 15-minute interval. We note that after 1815 hours on September 10, the number of jets taxiing out stabilized at around 15. As a result, the taxi-out times stabilized at about 16 minutes. Pushback rate control smooths the rate of the pushbacks so as to bring the airport state to the specified state, N_{ctrl}, in a controlled manner. Both features of pushback rate control, namely, smoothing of demand and prevention of congestion can be observed by comparing the evenings of September 10 and September 15. We see that on September 15, in the absence of pushback rate control, as traffic started accumulating at 1745 hours, the average taxi-out time grew to over 20 minutes. During the main departure push (1830 to

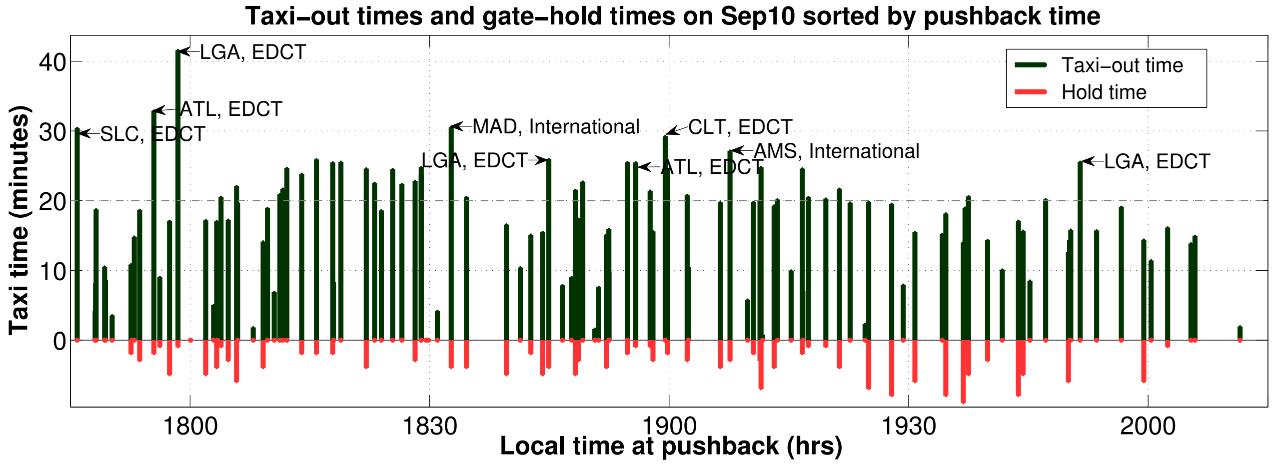

Fig. 11: Taxi-out and gate-hold times from the field test on September 10, 2010.

1930), the average number of jets taxiing out stayed close to 20 and the average taxi-out time was about 25 minutes.

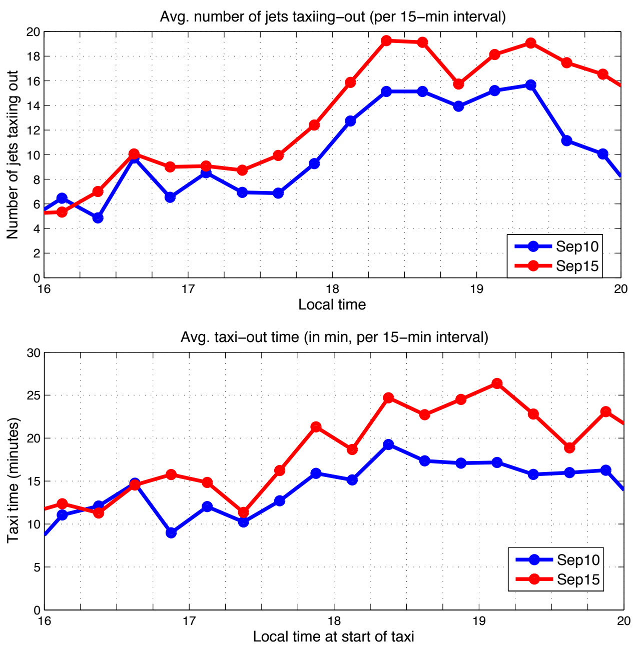

Fig. 12: Surface congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and visual weather conditions, but without pushback rate control. Delay attributed to EDCTs has been removed from the taxi-out time averages.

Similarly, Figure 13 compares the results of a characteristic pushback rate control day in runway configuration 27, 22L | 22L, 22R, August 26, to a similar day without pushback rate control. We observe that for on August 26, the number of jets taxiing out during the departure push between 1830 and 1930 hours stabilized at 15 with an average taxi-out time of about 20 minutes. On August 17, when pushback rate control was not in effect, the number of aircraft reached 20 at the peak of the push and the average taxi-out times were higher than those of August 26.

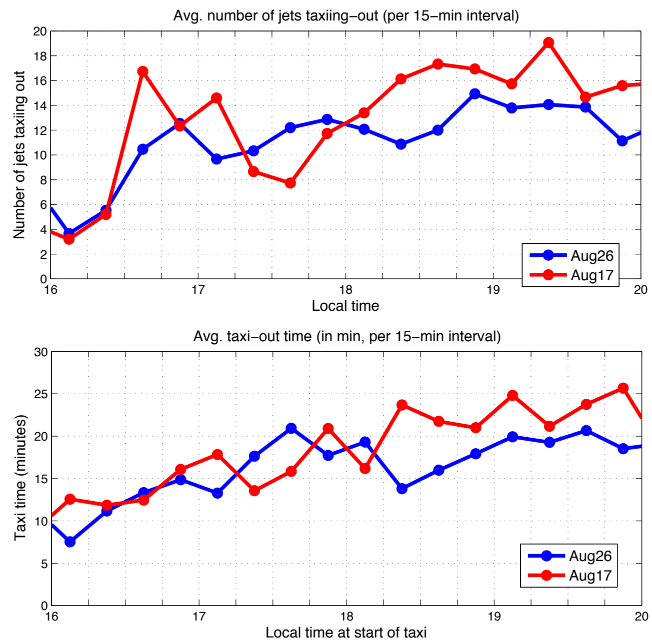

Fig. 13: Ground congestion (top) and average taxi-out times (bottom) per 15-minutes, for (blue) a day with pushback rate control, and (red) a day with similar demand, same runway configuration and weather conditions, but without pushback rate control. Delay attributed to EDCTs has been removed from the taxi-out time averages.

B. Runway utilization

The overall objective of the field test was to maintain pressure on the departure runways, while limiting surface congestion. By maintaining runway utilization, it is reasonable to expect that gate-hold times translate to taxi-out time reduction, as suggested by Figure 9. We therefore also carefully analyze runway utilization (top) and departure queue sizes (bottom)

during periods of pushback rate control, as illustrated in Figure 14.

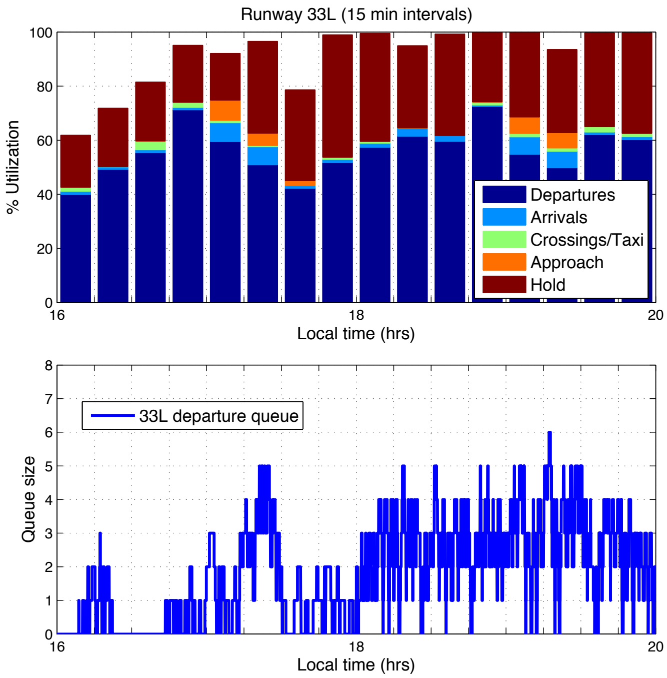

Fig. 14: Runway utilization plots (top) and queue sizes (bottom) for the primary departure runway (33L) during the field test on September 10, 2010. These metrics are evaluated through the analysis of ASDE-X data.

In estimating the runway utilization, we determine (using ASDE-X data) what percentage of each 15-min interval corresponded to a departure on takeoff roll, to aircraft crossing the runway, arrivals (that requested landing on the departure runway) on final approach, departures holding for takeoff clearance, etc. We note that between 1745 and 2000 hours, when gate-holds were experienced, the runway utilization was kept at or close to 100%, with a persistent departure queue as well.

Runway utilization was maintained consistently during the demo periods, with the exception of a three-minute interval on the third day of pushback rate control. On this instance, three flights were expected to be at the departure runway, ready for takeoff. Two of these flights received EDCTs as they taxied (and so were not able to takeoff at the originally predicted time), and the third flight was an international departure that had longer than expected pre-taxi procedures. Learning from this experience, we were diligent in ensuring that EDCTs were gathered as soon as they were available, preferably while the aircraft were still at the gate. In addition, we incorporated the longer taxi-out times of international departures into our predictions. As a result of these measures, we ensured that runway utilization was maintained over the remaining duration of the trial. It is worth noting that the runway was "starved" in this manner for only 3 minutes in over 37 hours of pushback rate control, demonstrating the ability of the approach to adapt to the uncertainties in the system.

V. Benefits analysis

Table II presents a summary of the gate-holds on the eight demo periods with sufficient congestion for controlling pushback rates. As mentioned earlier, we had no significant congestion when the airport was operating in its most efficient configuration (4L, 4R | 4L, 4R, 9).

TABLE II
SUMMARY OF GATE-HOLD TIMES FOR THE EIGHT DEMO PERIODS WITH SIGNIFICANT GATE-HOLDS.

	Date	Period	Configuration	No. of gate-holds	Average gate-hold (min)	Total gate-hold (min)
1	8/26	4.45-8PM	27,22L | 22L,22R	63	4.06	256
2	8/29	4.45-8PM	27,32 | 33L	34	3.24	110
3	8/30	5-8PM	27,32 | 33L	8	4.75	38
4	9/02	4.45-8PM	27,22L | 22L,22R	45	8.33	375
5	9/06	5-8PM	27,22L | 22L,22R	19	2.21	42
6	9/07	5-7.45PM	27,22L | 22L,22R	11	2.09	23
7	9/09	5-8PM	27,32 | 33L	11	2.18	24
8	9/10	5-8PM	27,32 | 33L	56	3.7	207
Total				247	4.35	1075

A total of 247 flights were held, with an average gate-hold of 4.3 min. During the most congested periods, up to 44% of flights experienced gate-holds. By maintaining runway utilization, we traded taxi-out time for time spent at the gate with engines off, as illustrated in Figures 9 and 11.

A. Translating gate-hold times to taxi-out time reduction

Intuitively, it is reasonable to use the gate-hold times as a surrogate for the taxi-out time reduction, since runway utilization was maintained during the demonstration of the control strategy. We confirm this hypothesis through a simple "what-if" simulation of operations with and without pushback rate control. The simulation shows that the total taxi-out time savings equaled the total gate-hold time, and that the taxi time saving of each flight was equal, in expectation, to its gate holding time. The total taxi-out time reduction can therefore be approximated by the total gate-hold time, or 1077 minutes (18 hours).

In reality, there are also second-order benefits due to the faster travel times to the runway due to reduced congestion, but these effects are neglected in the preliminary analysis.

B. Fuel burn savings

Supported by the analysis presented in Section V-A, we conduct a preliminary benefits analysis of the field tests by using the gate-hold times as a first-order estimate of taxi-out time savings. This assumption is also supported by the taxi-out time data from the tests, such as the plot shown in Figure 9. Using the tail number of the gate-held flights, we determine the aircraft and engine type and hence its ICAO taxi fuel burn index [12]. The product of the fuel burn rate index, the number of engines, and the gate-hold time gives us an estimate of the fuel burn savings from the pushback rate control strategy. We can also account for the use of Auxiliary Power Units (APUs) at the gate by using the appropriate fuel burn rates

[13]. This analysis (not accounting for benefits from reduced congestion) indicates that the total taxi-time savings were about 17.9 hours, which resulted in fuel savings of 12,000-15,000 kg, or 3,900-4,900 US gallons (depending on whether APUs were on or off at the gate). This translates to average fuel savings per gate-held flight of between 50-60 kg or 16-20 US gallons, which suggests that there are significant benefits to be gained from implementing control strategies during periods of congestion. It is worth noting that the per-flight benefits of the pushback rate control strategy are of the same order-of-magnitude as those of Continuous Descent Approaches in the presence of congestion [14], but do not require the same degree of automation, or modifications to arrival procedures.

C. *Fairness of the pushback rate control strategy*

Equity is an important factor in evaluating potential congestion management or metering strategies. The pushback rate control approach, as implemented in these field tests, invoked a First-Come-First-Serve policy in clearing flights for pushback. As such, we would expect that there would be no bias toward any airline with regard to gate-holds incurred, and that the number of flights of a particular airline that were held would be commensurate with the contribution of that airline to the total departure traffic during demo periods. We confirm this hypothesis through a comparison of gate-hold share and total departure traffic share for different airlines, as shown in Figure 15. Each data-point in the figure corresponds to one airline, and we note that all the points lie close to the 45-degree line, thereby showing no bias toward any particular airline.

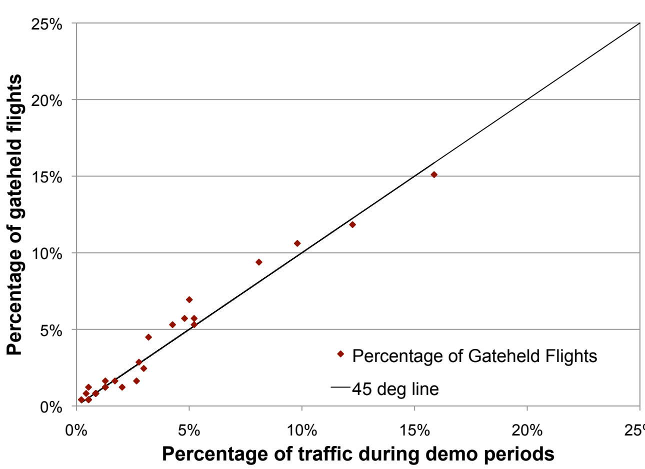

Fig. 15: Comparison of gate-hold share and total departure traffic share for different airlines.

We note, however, that while the number of gate-holds that an airline receives is proportional to the number of its flights, the actual fuel burn benefit also depends on its fleet mix. Figure 16 shows that while the taxi-out time reductions are similar to the gate-holds, some airlines (for example, Airlines 3, 4, 5, 19 and 20) benefit from a greater proportion of fuel savings. These airlines are typically ones with several heavy jet departures during the evening push.

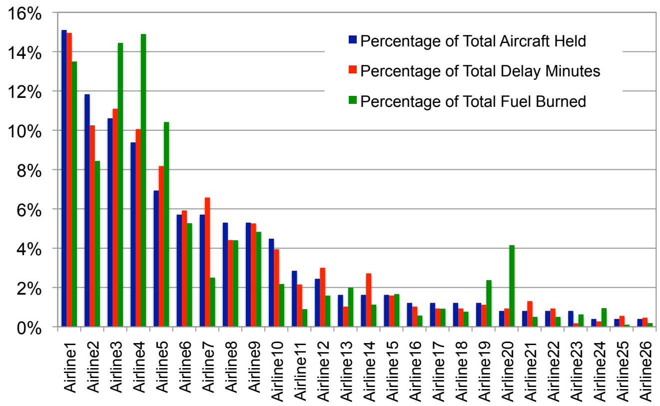

Fig. 16: Percentage of gate-held flights, taxi-out time reduction and fuel burn savings incurred by each airline.

VI. Observations and Lessons Learned

We learned many important lessons from the field tests of the pushback rate control strategy at BOS, and also confirmed several hypotheses through the analysis of surveillance data and qualitative observations. Firstly, as one would expect, the proposed control approach is an aggregate one, and requires a minimum level of traffic to be effective. This hypothesis is further borne by the observation that there was very little control of pushback rates in the most efficient configuration (4L, 4R | 4L, 4R, 9). The field tests also showed that the proposed technique is capable of handling target departure times (e.g., EDCTs), but that it is preferable to get EDCTs while still at gate. While many factors drive airport throughput, the field tests showed that the pushback rate control approach could adapt to variability. In particular, the approach was robust to several perturbations to runway throughput, caused by heavy weight category landings on departure runway, controllers' choice of runway crossing strategies, birds on runway, etc. We also observed that when presented with a suggested pushback rate, controllers had different strategies to implement the suggested rate. For example, for a suggested rate of 2 aircraft per 3 minutes, some controllers would release a flight every 1.5 minutes, while others would release two flights in quick succession every three minutes. We also noted the need to consider factors such as ground crew constraints, gate-use conflicts, and different taxi procedures for international flights. By accounting for these factors, the pushback rate control approach was shown to have significant benefits in terms of taxi-out times and fuel burn.

VII. Summary

This paper presented the results of the demonstration of a pushback rate control strategy at Boston Logan International Airport. Sixteen demonstration periods between August 23 and September 24, 2010 were conducted in the initial field trial phase, resulting in over 37 hours of research time in the BOS tower. Results show that during eight demonstration periods

(about 24 hours) of controlling pushback rates, over 1077 minutes (nearly 18 hours) of gate holds were experienced during the demonstration period across 247 flights, at an average of 4.3 minutes of gate hold per flight (which correlated well to the observed decreases in taxi-out time). Preliminary fuel burn savings from gate-holds with engines off were estimated to be between 12,000-15,000 kg (depending on whether APUs were on or off at the gate).

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References

[1] I. Simaiakis and H. Balakrishnan, “Analysis and control of airport departure processes to mitigate congestion impacts,” *Transportation Research Record: Journal of the Transportation Research Board*, pp. 22–30, 2010.

[2] C. Cros and C. Frings, “Alternative taxiing means – Engines stopped,” Presented at the Airbus workshop on Alternative taxiing means – Engines stopped, 2008.

[3] E. R. Feron, R. J. Hansman, A. R. Odoni, R. B. Cots, B. Delcaire, W. D. Hall, H. R. Idris, A. Muharremoglu, and N. Pujet, “The Departure Planner: A conceptual discussion,” Massachusetts Institute of Technology, Tech. Rep., 1997.

[4] N. Pujet, B. Delcaire, and E. Feron, “Input-output modeling and control of the departure process of congested airports,” *AIAA Guidance, Navigation, and Control Conference and Exhibit, Portland, OR*, pp. 1835–1852, 1999.

[5] F. Carr, “Stochastic modeling and control of airport surface traffic,” Master’s thesis, Massachusetts Institute of Technology, 2001.

[6] P. Burgain, E. Feron, J. Clarke, and A. Darrasse, “Collaborative Virtual Queue: Fair Management of Congested Departure Operations and Benefit Analysis,” *Arxiv preprint arXiv:0807.0661*, 2008.

[7] P. Burgain, “On the control of airport departure processes,” Ph.D. dissertation, Georgia Institute of Technology, 2010.

[8] I. Simaiakis and H. Balakrishnan, “Queuing Models of Airport Departure Processes for Emissions Reduction,” in *AIAA Guidance, Navigation and Control Conference and Exhibit*, 2009.

[9] ——, “Departure throughput study for Boston Logan International Airport,” Massachusetts Institute of Technology, Tech. Rep., 2011, No. ICAT-2011-1.

[10] I. Simaiakis, “Modeling and control of airport departure processes for emissions reduction,” Master’s thesis, Massachusetts Institute of Technology, 2009.

[11] Federal Aviation Administration, “Fact Sheet Airport Surface Detection Equipment, Model X (ASDE-X),” October 2010.

[12] International Civil Aviation Organization, “ICAO Engine Emissions Databank,” July 2010.

[13] Energy and Environmental Analysis, Inc., “Technical data to support FAA’s circular on reducing emissions for commercial aviation,” September 1995.

[14] S. Shresta, D. Neskovic, and S. Williams, “Analysis of continuous descent benefits and impacts during daytime operations,” in *8th USA/Europe Air Traffic Management Research and Development Seminar (ATM2009)*, Napa, CA, June 2009.

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